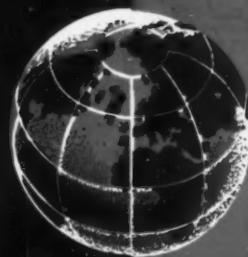


JANUARY 1958

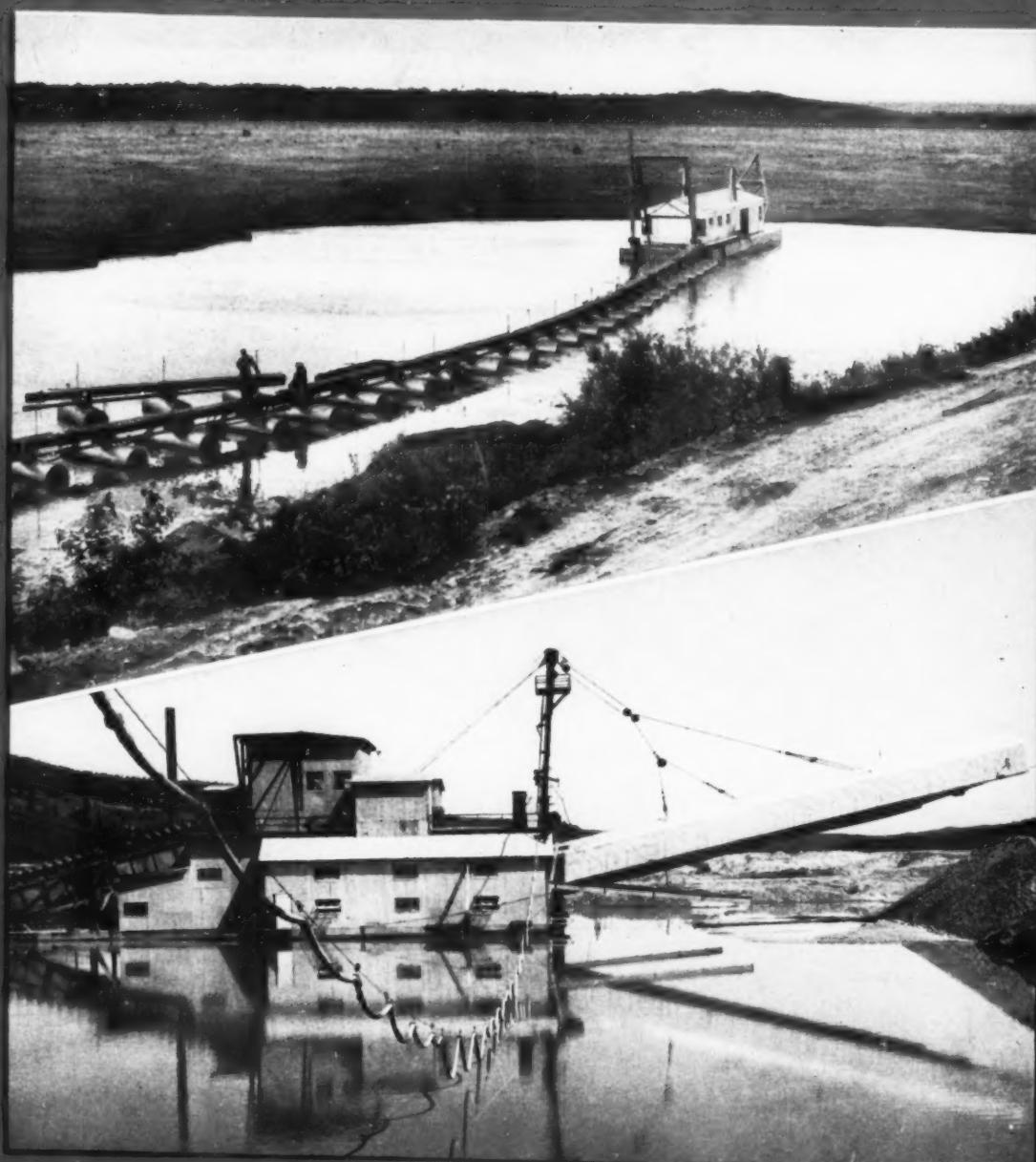
VOL. 20 NO. 1

MINING WORLD



What Were The Key Mining
Events in 1957? Page 44

Rio de Oro Now Mining
600 Tons Daily Page 58



Dredging: Minnesota Iron — Idaho Columbite-Tantalite

Pages 38 and 52

50 cents a copy—3s 6d in sterling

INSPIRED METALLURGY*

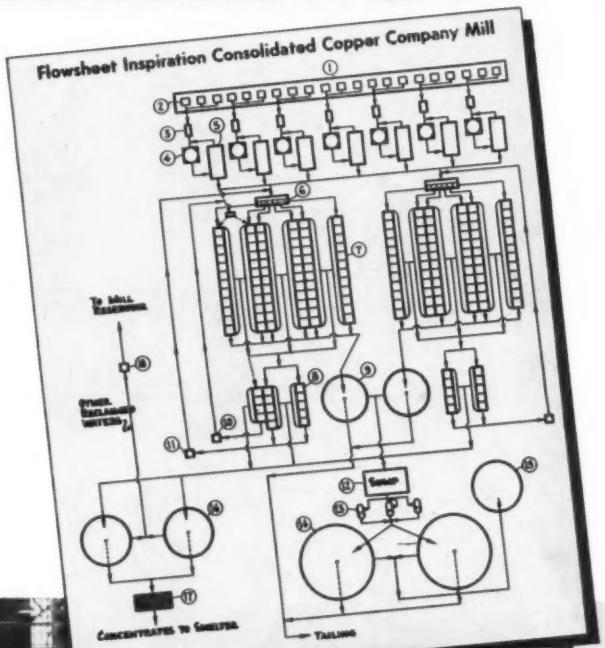
extends INSPIRATION'S reserves

A new lease on life has been achieved by Inspiration Consolidated Copper Company, Inspiration, Arizona, through the complete rehabilitation of facilities idle for over a quarter of a century. Below are some of the highlights of the operation. For complete details, write for Wemco Bulletin F5-B30.

- * Dual Process, using acid leach for oxide fractions and flotation for sulphides.
- * Increase in capacity, originally 10,000 tons, now 15,000 tons of ore per day.
- * Simple flow sheet, with unique test circuit providing for a 2,500 t.p.d. pilot plant within the commercial circuit.
- * Wemco-Fagergren flotation machines used throughout; 144 cells for roughing, 24 for cleaning.



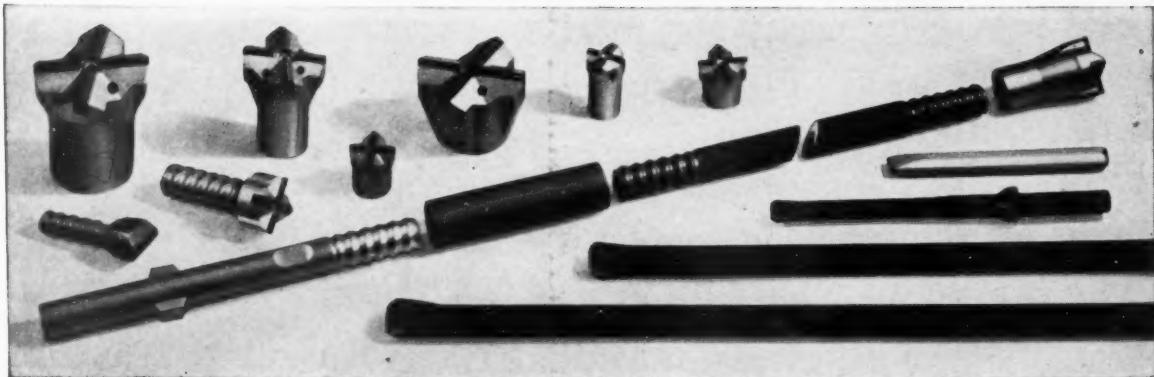
Wemco Fagergrens are controlled from a console, with a separate indicator for each unit.



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7/8" hollow hexagon	1'4"-21'0"
1" hollow hexagon	2'6"-21'0"
Flexible drill steels	2'7"-31'6"

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The threads of Sandvik Coromant (cross and X-design) bits are precision milled. The bits are so accurately manufactured that not only smoother drilling but *longer life* are ensured. Standard bit diameter sizes range from 1½" to 4½". The 773 bits (bottoming type) are available with GD400

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The rope-threaded joints of Sandvik Coromant extension steels are solid and make joining and unscrewing extremely easy. Sizes available: 7/8" and 1" hexagon steels, 1½" and 2" round steels. A special feature of the 1½" equipment is the 1" flushing hole, about twice as large as most. This gives better cleaning of the bore hole and a higher rate of advance, reduces wear and risk of steels sticking. The 'cold rolling' technique makes this wider flushing hole possible *without any loss of strength*.

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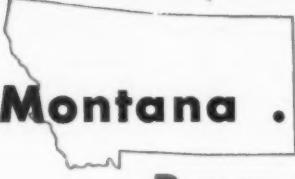
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**Bucyrus-Erie Electric Shovels
are a First Step to Profitable Production**

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Mining World

Including the Export Edition WORLD MINING

Published monthly except in April when publication is semi-monthly

VOLUME 20

JANUARY 1958

No. 1

OPERATIONS—TECHNOLOGY

Dredging

Porter Bros. Dredges Idaho Columbite-Tantalite 38

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J&L Dredges Mesabi Iron Tailing Pile 52

By HOWARD L. WALDRON

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By GEORGE O. ARGALL, JR.

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By AXEL W. KJELGAARD

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ON THE COVER

Jones & Laughlin Steel Corporation uses the dredge, at the top, to recover iron ore tailing for retreatment by gravity-flotation at Calumet, Minnesota. The bottom picture shows Porter Bros. Corporation's Yuba dredge digging columbite-tantalite-uranium bearing gravel in Bear Valley, Idaho.



MILLER FREEMAN PUBLICATIONS



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GRAB SAMPLES From the Mail

Backfill at Banner

Dear Sir:

The article on Banner Mining Company's Arizona copper developments in MINING WORLD of November 1957 contained an error of fact on page 40 in the description of results obtained by our hydraulic backfill plant. The cyclone overflow is actually 100 percent minus-325-mesh, and not 90 as stated in the article. The underflow sand which is used for backfilling contains about 32 percent minus-325-mesh, instead of 10 as stated. The correct screen analysis is as shown below.

2 MODEL D10B KREBS CYCLONES		
	Feed	Overflow Underflow
PSI	25	
GPM	338	276 62
% Solids	29.0	9.0 74.0
TPH	30.4	6.5 23.9
SIZING		
% +100	4.9	6.2
+150	10.2	13.0
+200	12.7	16.2
+325	25.2	32.2
-325	47.0	100.0 32.4

In fairness to Equipment Engineers, who manufacture the Krebs cyclones used in our plant, we would appreciate your publishing this correction.

B. W. VENABLE
General mine superintendent
Banner Mining Company

Stockholm Meeting Coverage

There have been many favorable comments "on the spot" report written by Mining World's general manager, Max F. Holsinger during his participation in the recent International Mineral Dressing Congress in Stockholm, Sweden.

It has also been called to our attention that an error appeared in reporting Mr. Holsinger as representing the only United States technical publication at the meeting. Actually at the meeting, but apparently not as an official delegate on the convention roster was Curt Agren, Stockholm correspondent for McGraw-Hill World News.

Wants Most Valuable Publication

Dear Sir:

I have been receiving a copy of your most valuable publication and I would be glad to continue to receive it at my changed address. The previous address was care Institute of Mining & Metallurgy, 44 Portland Place, London W. 1, England.

I am the Australian Representative of Combined Development Agency, as well as the United Kingdom Atomic Energy Authority, and would be grateful if you can be so kind as to send WORLD MINING to me here.

J. B. RICHARDSON
United Kingdom
Atomic Energy Authority
Sydney, Australia

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MILLER FREEMAN PUBLICATIONS

JANUARY 1958

Drifts and Crosscuts

Cut Costs To Stay Competitive

The mining industry enters 1958 faced with the strongest competitive situation in a number of years. United States metals face competition with foreign imports; chrome, mercury, tin, zinc, and other metals produced in the Free World face growing competition with metals produced behind the Iron Curtain; and the always competitive situation between metals and synthetics and substitutes continues.

There is little likelihood in the near future of either civilian or military demands reaching heights such as to preclude sales competition. It takes time for the many fine mining industry research, development, and educational programs now underway to expand demand up to production capacities.

Nothing points to any still-secret use which might suddenly and mysteriously cause such a shortage of metals that it would be profitable to seek, find, and produce them in great volume.

Today's metal position has aptly been defined by L. F. Pett, Utah Copper Division Manager, Kennecott Copper Corporation, as follows, "For many years the emphasis has been on a maximum output. Now the emphasis must be on efficiency and lower costs." Cost of supplies, equipment, labor, freight, fuel etc. are rising. The mining companies all have made drastic revisions and changes to lower operating costs. Economy programs extend across the full length of operations from decreases in exploration to reductions in plant metal inventories.

Labor is fully aware of the situation and has cooperated to keep domestic mines in operation all the way from lay-offs to appearing before the United States Tariff Commission.

The long-term position of the industry was never brighter. Increased standards of living on a world-wide scale, increased population, and increased mechanization all add up to more demand for metal. The consumption curve has levelled off but its long-term trend is and always will be up.

Today, it's cut costs; tomorrow, it can only be to produce more metal. Can This Be A Tip For Domestic Uranium?

The United States Atomic Energy Commission's recent disclosure that additional new milling facilities not already proposed would not be considered was not without precedent. The Canadian government did virtually the same thing over a year ago when it limited purchase contracts. In South Africa the Combined Development Agency (United States and Great Britain) designated specific companies as uranium producers, thus assuring a market and an adequate price.

Now that the Combined Agency has refused to buy uranium from Klerksdorp Consolidated Goldfields Ltd. through the South African Atomic Energy Board, the Board is now free to dispose of such possible production elsewhere. And preliminary negotiations with other prospective purchasers are already underway.

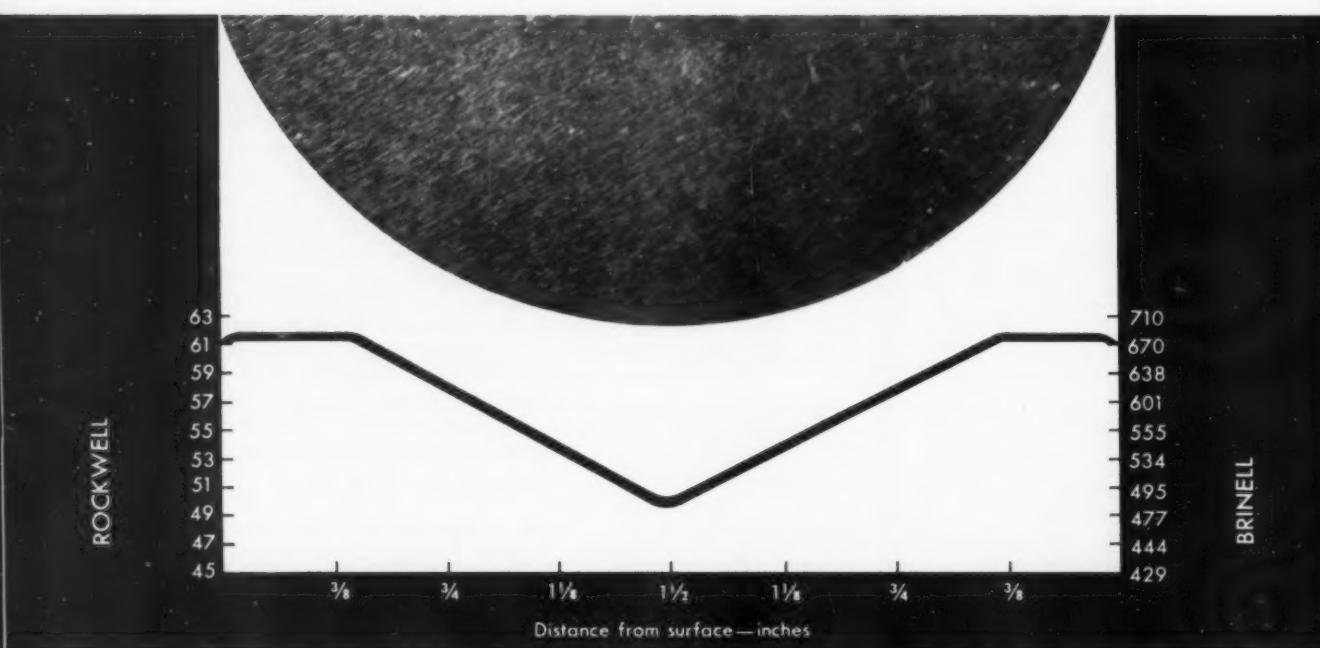
Will the next step in the United States be similar? That would amount to approval for new mill construction with concentrate output to be sold to other than the A.E.C.; that is, sale within the bounds of military-use security.

Reading the uranium past makes it a possibility.

controlled metal hardness means
heat-treated cast alloy steel

NACO GRINDING BALLS

cut per-ton grinding costs



Note how new casting process and full heat treatment show controlled hardness between surface and inner core.

Spectrographic analytical control of elements in steel making processes and controlled heat treatment assure the desired metallurgical grain structure which produce the type of hardness required for maximum wearing qualities.

Performance reports on Naco solid cast alloy steel grinding balls from mills now using them have been universally favorable—both in lasting qualities and impact absorption.

Structurally, they possess a grain

closely approaching tool steel—tough, hard and rugged for long lasting qualities. Laboratory tests show a remarkable uniformity in solidity, both under X-ray and specific gravity tests, with controlled hardness holding to a desired depth.

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MINING WORLD NEWSLETTER

San Francisco, California

January 1958

Start of the new year is a good time to appraise the record of the old one. Surprisingly high were the production figures for the mining industry, although the year did end on a downward turn.

Estimated 1957 production from the mining industry is compared here with actual 1956 output. (Final 1957 figures should be released by the Bureau of Mines shortly.)

	<u>1956</u>	<u>1957</u>
Aluminum	1,678,954 short tons	1,580,000
Antimony (mine output)	590 * *	640
Chrome (" ")	161,555	158,000
Cobalt	3,595,028 pounds	3,150,000
Copper	1,106,215 short tons	1,050,000
Gold	1,814,228 fine ounces	1,700,000
Iron	97,848,936 long tons	105,440,000
Lead	352,826 short tons	330,000
Manganese (ore)	344,735 short tons	360,000
Mercury	24,177 flasks	31,900
Molybdenum	57,462,000 pounds	59,500,000
Silver	37,127,149 fine ounces	39,800,000
Sulphur	6,450,000 long tons	5,460,000
Titanium (metal)	14,595 short tons	18,200
Tungsten (60%)	15,509 short tons	7,000
Uranium (concentrate)	6,000 tons	9,500
Zinc	542,340 short tons	498,000

Some observations on apparent production gains:

Copper—Any output over 1,000,000 tons will be the second highest in U.S. copper mining history. Arizona produced at an all-time rate during the first six months of the year; then declined. The state's annual total will probably be about 500,000 tons, which is very close to 1956. Biggest drop came in Montana where Anaconda cut back operations. Washington almost ceased to compete as a copper producer with the shutdown of Howe Sound activities.

Iron—No major strikes in the steel industry helped to increase this output. Lake Superior shipments were the fifth highest on record. The season started with high goals, but demand slackened in the third quarter.

Mercury—California's New Idria mined more high-grade ore during the year, while Abbott mine of California Quicksilver Mines maintained steady production. Rare Metals Corporation of America operated its Weiser, Idaho property at maximum capacity, and Alaska added to the picture with a substantial increase from the Red Devil mine.

Molybdenum—Climax milled greater tonnage during the year, while San Manuel completed its first year of major tonnage of molybdenum byproduct.

Titanium reached an all-time high although cutbacks in government aircraft projects in the last part of the year have reduced demand making the future uncertain.

Uranium concentrate output rose considerably because of the opening of two new mills. In the first half of the year, production totaled 4,200 tons; the remaining gains were made with the start of production by Dawn Mining Company and Western Nuclear Corporation. Some initial production also came from Trace Elements and Texas-Zinc Minerals' plants which are scheduled for full operation in 1958.

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comes...

the **TRAXCAVATOR'S**



new...

SIDE DUMP BUCKET!

—Directly interchangeable with standard bucket...same pins, bolts and nuts!
—Easy to operate! Dumps to the left as well as forward!

Now the famed Cat-built No. 955 and No. 933 Traxcavators are more versatile than ever! The new Side Dump Bucket attachment gives you

- Higher production, because cycle time can be cut
- Lower maintenance, greatly reduced ground scuffing, because turning when loading is no longer necessary
- Easier handling because the unit now needs less space for loading and truck spotting.

And you retain all the regular Traxcavator's popular features. Lockout-kickout, bucket positioner, 40-degree tilt-back, one-hand bucket control. No interference, either, with other Traxcavator* attachments when you equip with the new CAT* Side Dump Bucket. Get complete details from your Caterpillar Dealer *now!*

Caterpillar Tractor Co., San Francisco, Calif.; Peoria, Ill., U.S.A.

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Side Dump Buckets Available for the
No. 955 and No. 933 Traxcavators!

	No. 955	No. 933
Bucket capacity	1 1/8 cu. yd.	1 1/8 cu. yd.
Overall width of bucket	96"	86 1/2"
Overall height, side dump	17' 5 1/2"	15' 6 1/4"
Overall height, level	14' 6"	12' 11 1/8"
Left side dump reach	24 1/2"	25 1/2"

A NEW DIMENSION IN
LOADER VERSATILITY



Capitol Concentrates

Lead-Zinc Industry Awaits Decision Of United States Tariff Commission

The lead-zinc hearings before the Tariff Commission are over and the industry waits uneasily for the verdict. If the recommendations are not sent to the President a week before Christmas, the chances are that they will go to the White House early in January.

The domestic producers—especially those either without smelters or whose smelters treat only a relatively small proportion of foreign concentrates—stood behind the Lead-Zinc Emergency Committee (130 members, nominally) for the maximum increase in tariffs permissible under the escape clause. The strictly domestic producers feel that the relief would not be sufficient and asked for quotas in addition. Those concerns which have foreign mines in addition to domestic properties or are treating foreign concentrates were in general strongly opposed to quotas and some did not want tariffs beyond the escape-clause relief. While the domestic producers were in this unhappy position of disagreement, the foreign producers—some with domestic smelters—presented a solid front against increased tariffs or quotas or, in fact, any sort of protection against cheap imports.

In spite of this, the best guessing in Washington is that the Tariff Commission will recommend the maximum escape-clause relief and may even suggest a quota system, although probably not the one concocted by the Emergency Committee. Should this be the case, the further guessing is that the President will act favorably upon the tariff increase recommendation and deny a quota recommendation should it be made.

In such case the members of the Emergency Committee who believe the relief to be inadequate probably will propose a bill to further increase the tariffs, hoping to get it through the House Ways and Means Committee during the next session of the Congress. Some highly placed officials feel that should such a bill pass, the President would veto it. Pressure on the State Department against any increases is very heavy and other governments, such as Canada and Mexico, are insisting upon further cuts on ores, concentrates, and products.

People who claim to be close to the United States Tariff Commission are of the opinion that the recommendations regarding lead-zinc tariffs will not be sent to the White House until January. If the report is late it is likely that a number of new lead-zinc tariff bills will be introduced into the next session of the Congress.

• Trade Agreements Act Is Controversial

Representative Hale Boggs, chairman of a House Subcommittee on Foreign Trade Policy, wrote a letter to the President early this year saying:

"You will recall that there were some very close

votes in the House on the trade-agreements legislation in 1955 when the Trade Agreements Extension Act of that year was enacted.

"You are also, no doubt, aware that the trade-agreements program and its administration have been the subjects of increasing criticism in recent years and that, in the present climate of public and Congressional opinion, the continuance of the program is by no means assured."

There is no doubt that there will be few more controversial matters before the Congress than the renewal of the trade agreements act and great efforts will be made to kill it off.

• Battle Over Mercury Containers Continues

After a terrific furor was raised about the change in specifications for flasks in which to deliver mercury under the government program, GSA still sticks to the change but is allowing the metal for current delivery to be held and bottled as late as March 31, 1958. This will allow current offerings to be credited against the 1957 program and will allow producers to go flask hunting.

GSA informed Senator James E. Murray, chairman of the Senate Interior Committee, that "there are many producers who can produce this type of flask—however, their decision to go into production would depend entirely on the market requirements for this type of flask since some investment in tooling would be required." Senator Murray has been informed that to date only one concern actually makes these flasks and at a considerably increased price over standard flasks. He has demanded that GSA absorb the increased cost so producers will not be penalized by this *ex post facto* change in regulations.

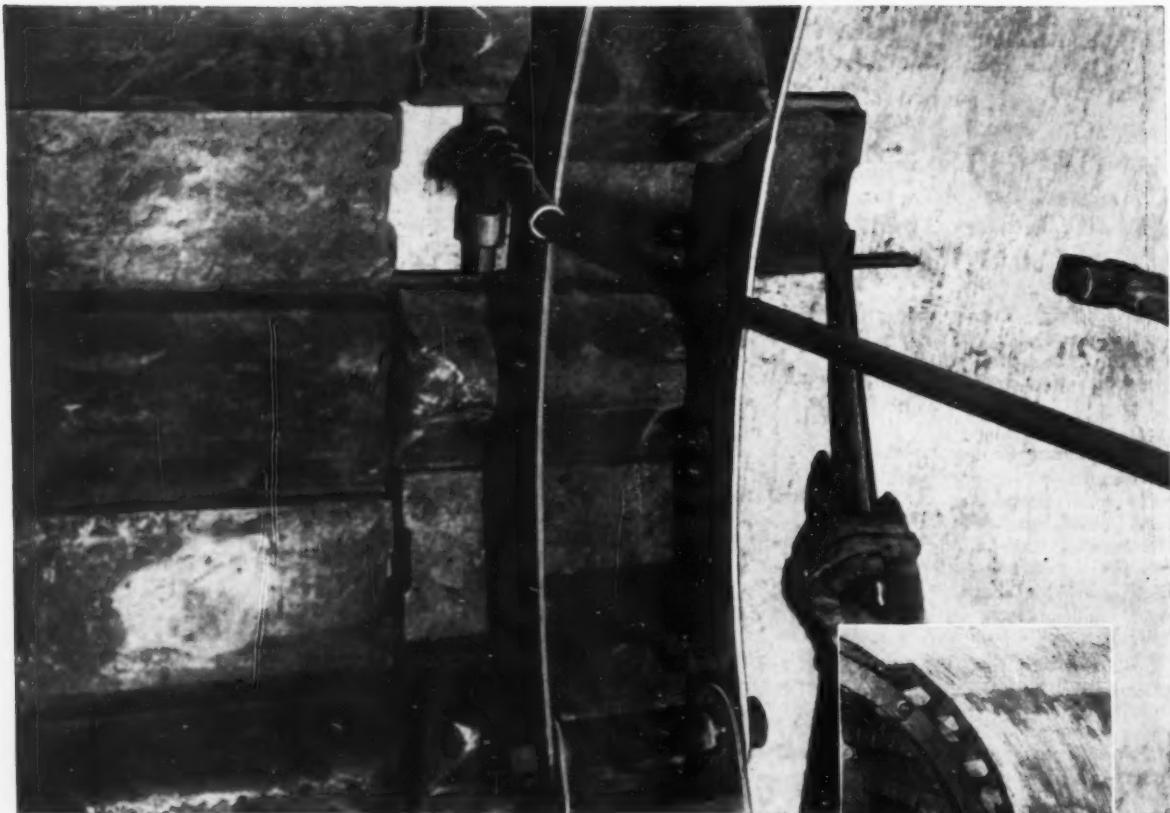
• San Francisco Plan Is Revived

The suggestion that the so-called San Francisco plan be applied to lead and zinc is becoming current again, this time from foreign quarters.

The San Francisco plan, expounded and recommended for various minerals at several conferences of western Governors, calls for the use of monies received from duties on foreign materials imported into the United States to pay subsidies to domestic producers. The present suggestions add the gimmick that the money somehow be proportioned among domestic producers according to need—possibly some sort of a premium price-plan. As imports fall off, there would be less need and less money available; as they increase and the domestic need for aid presumably becomes greater, there would be more money to divide. Some people think this plan to be superior to disturbing international trade by raising tariffs.

• It's A Possibility

Jesse Johnson, chief of the AEC raw materials division, has remarked that atomic power might become a benefit to the coal industry some day by making it cheaper to process coal for its by-products.



How B&W Standardized Universal Liner Plates Speed Mill Installations

Uniform Castings Fit All Mill Sizes

B&W Universal Liner Plates save manhours and reduce mill downtime because they are quick and easy to install. Since the same casting fits all mill sizes, B&W standardization also means lower costs, higher performance, longer life and less breakage in your operations.

Here is the simplified installation procedure:

1. Lay liners in bottom half of the mill with the desired lifter centers.
2. Then, place in position a simple installation form and complete the ring of liners without turning the mill. The last casting in each ring is wedged tightly into place by means of a hydraulic ram and locked with a pin. The joints are designed to permit the use of a spacer pin where needed. The number of pins in a ring depend upon shell variations and lifter centers used.

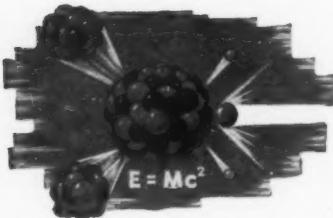
With B&W Universal Liner Plates, direct labor cost and installation downtime are reduced. Small, lightweight castings are easily handled, minimizing worker fatigue and eliminating the necessity for cranes. Also, B&W Universal Liner Plates give longer life

of greater usefulness. Uniform wear results from better quality control on a mass production casting with permanent molds. You save money on liner inventory, breakage claims and delays for replacements. Positive seating of small castings on mill shell means less breakage of castings under operating conditions. Costs are also reduced for storage space since small castings stack easily.

Liners are supplied in two nominal thicknesses, $1\frac{1}{2}$ " and 3" with $1\frac{1}{2}$ " high lifters. Castings are 6" wide x 12" long. For additional information on B&W Universal Liner Plates, write The Babcock & Wilcox Company, Process Equipment Dept., Barberton, Ohio.

S-472





FISSION FACTS

Monthly Roundup of Mining News
In the Atomic Energy Field

Three AEC Contracts To Western Producers

Three new contracts have been awarded by the United States Atomic Energy Commission for the sale of uranium concentrates. Uranium processing mills to fulfill these contracts will be erected by Fremont Minerals, Inc. at Riverton, Wyoming; by American Milling Corporation and Atomic Resources Corporation near Monticello, Utah; and by Lakeview Mining Company at Lakeview, Oregon.

The \$2,600,000 mill to be constructed by Lakeview Mining Company will be the first uranium processing mill in Oregon. The plant, expected to be completed late in 1958, will have a daily capacity of 210 tons and will employ 60 men. Uranium ore from Lakeview's White King and Lucky Lass claims on Augur Creek in eastern Oregon will be treated at the new mill and one fifth of the capacity will be used for custom ores if any are available from independent producers in the area.

Fremont's plant, representing a \$3,500,000 investment, will have a capacity of about 500 tons of ore per day and is expected to be completed in about 12 months. The new mill will be equipped to treat a wide range of different types of uranium ore mined in the area, including both limestone and sandstone types. Ore from independent operators as well as the government stockpile at Riverton will be treated. Beginning on February 1, Fremont will operate the government-owned ore buying station at Riverton and purchase ore in the Wyoming area. The government installation will be closed when ore buying facilities at the new mill begin operating. Fremont Minerals, Inc. is a subsidiary of the Susquehanna Corporation of Chicago, Illinois, which is also the parent company of Mines Development, Inc., operators of a uranium processing mill at Edgemont, South Dakota.

A pilot plant with a 25-ton mill to process uranium-vanadium ore on an experimental basis will be constructed by American Milling and Atomic Resources Corporation. Under the joint agreement, American Milling will purchase 20 percent interest in Atomic Resources' known ore body, which will provide material for the milling process. A new method of milling, known as the Yucca process, will be used.

Two other uranium milling projects have been proposed, but to date no AEC contracts have been awarded. Vitro Minerals Corporation and the Atlas Corporation have submitted a joint proposal to build a 1,000-ton-per-day uranium mill in the Gas Hills mining area of Wyoming. Vitro has drilled more than 500,000 feet in a \$2,250,000 exploration and development program carried out on 25 percent of the company's Gas Hills holdings. Reserves of more than 1,500,000 tons of uranium ore have been indicated. Current holdings include 207 uranium claims which cover over 4,000 acres.

Homestake's Headframes Rise Over Ambrosia Lake



Homestake Mining Company, through its two New Mexico partnership groups—Homestake-New Mexico Partners and Homestake-Sapin Partners, is developing four major underground uranium mines to supply ore to the new mill being built by Homestake for each partnership group. The top picture shows the new steel headframe over the projected 830-foot-deep Section 23 shaft. Section 23 will be Homestake's mining headquarters with offices, warehouse, and change room in the new building behind the headframe. Estimated ore reserves on this Section are 1,216,950 tons assaying 0.27 percent U_3O_8 including a 10 percent dilution factor. The lower picture

As Underground Development Starts In Earnest



shows the new steel headframe and surface plant at the Section 15 mine northwest of 23. Both shafts are on ground controlled by Homestake-Sapin. Section 15 shaft will be 595 feet deep and an estimated 356,920 tons of 0.27 percent ore (including dilution) will be hoisted through this shaft. Section 15 will get into production ahead of 23 because full-scale sinking started late in October 1957 ahead of that at 23. It will also have the advantage that mining will be speeded because reserves include appreciable tonnages of "dry" ore.



Roof Bolting at the Face Minimizes Danger of Rock Falls

When you install Bethlehem Pacific headed or slotted roof bolts at the face, using a predetermined pattern, the mine roof becomes safer, less likely to fall. The roof bolts lock themselves in drilled holes, anchoring the strata into a thick, self-supporting beam.

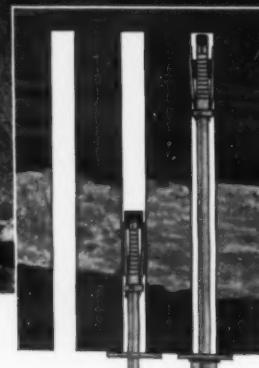
With such a roof bolting installation, wider openings and clearances are possible. And because there are no bulky supports, mechanized equipment can be maneuvered easily, even right up to the face. Besides, there's no fire hazard involved.

Bethlehem Pacific headed roof bolts are furnished in three types:

1. $\frac{3}{4}$ -in. high-strength; typical breaking load 34,000 lb.
2. $\frac{5}{8}$ -in. high-strength; typical breaking load 24,000 lb.
3. $\frac{7}{8}$ -in. high-strength; typical breaking load 45,000 lb.

Bethlehem Pacific slotted roof bolts are of 1-in. diam; typical breaking load 45,000 lb.

We would be happy to give you further information about Bethlehem Pacific mine roof bolts. Just contact our nearest sales office.



Assembly, consisting of square-head bolt, square roof plate, malleable-iron shell and steel plug, is inserted in drilled hole.

Bolt is tightened, drawing down plug, and expanding leaves of shell.

Roof plate provides additional support. Steel tie may be used instead.

BETHLEHEM PACIFIC COAST STEEL CORPORATION

Sales Offices: Phoenix, Los Angeles, San Francisco, Spokane, Seattle, Portland



BETHLEHEM PACIFIC



LIMA...built to stay on the job- keep output up, costs down

Every day Limas throughout the world are proving their worth in every type of excavating or crane work. Carefully engineered for modern, high-speed operation, these rugged, powerful machines handle the toughest stripping, digging, loading and lifting jobs with effortless speed. Their built-in stamina assures high output with lowest downtime. Easily maneuverable they move and work in the tightest spots, getting jobs done well ahead of schedule. Fingertip precision air controls pave the way for smooth, easy operations. For assignments calling for electrically powered machines, all Limas are available with optional electrical power package. Combining a single AC electric motor

with a single stage torque converter, this drive matches, *electrically*, diesel-torque converter performance. You get maximum power performance under all operating conditions . . . and the motor won't stall or burn out. Lima quality design and construction extras make for profitable, efficient operations with minimum downtime. There's a Lima type and size for every job—shovels to 6 cu. yds., cranes to 110 tons and draglines variable. Smaller capacities are available on rubber. For full details, contact your nearby Lima distributor, or write to Construction Equipment Division, Baldwin-Lima-Hamilton Corporation, Lima, Ohio.

Lima Roadpacker
for high-density
subbase finishing in
road and airport runway construction.



Lima Austin-Western
crushing, screening
and washing plants for portable
or stationary operation.



DISTRIBUTORS IN PRINCIPAL CITIES OF THE WORLD

LIMA

SHOVELS • CRANES
DRAGLINES • PULLSHOVELS

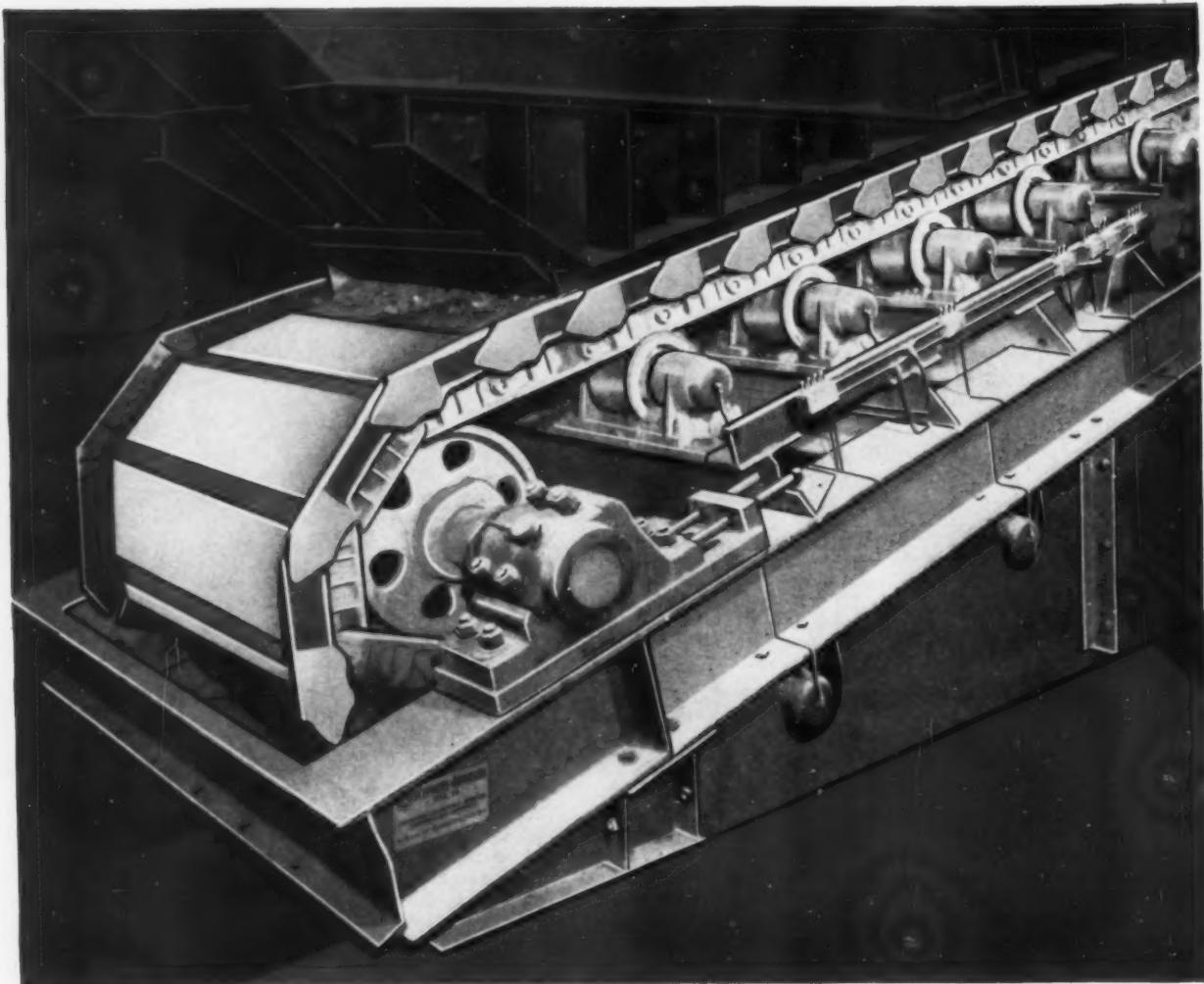


BALDWIN-LIMA-HAMILTON
Construction Equipment Division — LIMA WORKS

"Cable Address: LIMASHOVEL, Lima, Ohio, U.S.A."

OTHER DIVISIONS: Austin-Western • Eddystone • Electronics & Instrumentation
Hamilton • Loewy-Hydropress • Madsen • Pelton • Standard Steel Works

CONTROLLING BULK MATERIAL FLOW



A STEPHENS-ADAMSON AMSCO feeder shown in a typical extra heavy-duty application, receiving and controlling flow of ore from a feeder bin. Both pans and chain are made of manganese steel.

STEPHENS-

THE BIG NAME IN BULK MATERIALS HANDLING



BELT CONVEYORS



IMPACT CARRIER



SELF TRAINING CARRIER



HOLDBACKS



BUCKET ELEVATORS & CONVEYORS

FROM BINS AND HOPPERS WITH...

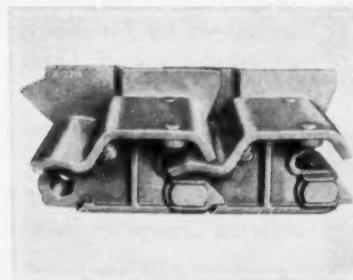


S-A **FEEDERS**

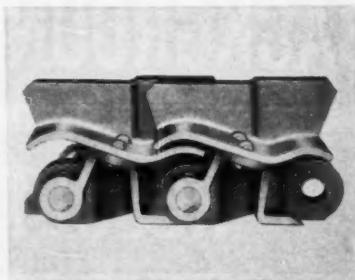
For many years, the mining industry has looked to STEPHENS-ADAMSON as the first source for all types of Feeders and Apron Conveyors. From light-duty units handling a few tons of light materials per hour, to giant AMSCO Feeders built to take the impact delivered by thousands of tons of run of mine ore and stone, S-A builds to fit the need. Material flow from bins and hoppers can be accurately controlled up to 3000 T.P.H. and more.

S-A Apron Feeders consist of a series of overlapping steel pans, riding on endless conveyor chain. Sideplates may be furnished when skirt boards are not used. Many pan styles are available depending on the application. AMSCO Feeders are provided with manganese steel pans and chain that become tougher with use and impact. Many are still in service after thirty years or more.

STEPHENS-ADAMSON has engineered and built some of the world's largest ore conveying systems. For fifty-six years S-A engineers have been dealing with and applying scientific techniques to solution of mining interest problems. That's why the S-A man in your area may be your shortest route to low cost per ton ore handling.



Cross section view of pan and chain used with heavy-duty type S-A feeder. Pans are made of $\frac{1}{8}$ inch high carbon steel and are formed in overlapping style to prevent leakage of material during feeder operation. Chain and sprockets are manganese steel.



Cross section view of pan and chain used with medium-duty type S-A feeder. Pans are formed from $\frac{1}{8}$ inch mild steel. Chain is malleable iron (ley bushed type). All S-A feeder chains are designed to prevent sagging between supporting rollers.

STEPHENS-ADAMSON EQUIPMENT

S-A district or main plant offices can supply complete information on any conveyor product or any phase of ore and stone handling. Bulletins on all products available upon request.



MFG. CO.

MAIN OFFICE AND PLANT
13 RIDGEWAY AVENUE
AURORA • ILLINOIS

PLANTS LOCATED IN: LOS ANGELES, CALIFORNIA
CLARKSDALE, MISSISSIPPI • BELLEVILLE, ONTARIO



BACKGROUND:

In 14 years of strip mining, the Dulin Bauxite Company, Inc., contracted for dirt removal. The company studied contractors' production records, types of equipment used.

RESULT:

Last year, when the Dulin firm bought its own equipment, it selected Caterpillar-built machines exclusively.

The picture above shows how the firm is using the equipment at its bauxite strip mining operation near Little Rock, Ark. In this pit some 300,000 yd. of overburden are being removed at the rate of 4,200 yd. per day by 3 CAT* DW21 Tractors with No. 470 LOWBOWL Scrapers, push-loaded by a mighty D9 Tractor.

Here is the result of experience in action—and doing fine! Says L. D. Riffe, vice-president of the firm: "We find that this method of moving dirt is the best from the standpoint of high production and economy."

There are plenty of good reasons why these rigs are the best method to move dirt. The DW21-No. 470 combination has the capacity for big-volume hauling—18 cu. yd. struck, 25 cu. yd. heaped. But more important than capacity, the No. 470's LOWBOWL design has greater loading efficiency than any other make of

scraper in its class. Actual tests show that the No. 470 gets its rated capacity load and is on its way while other scrapers are still in the cut, struggling for the last few yards. And when it has its big load, the 300 HP (maximum output) DW21 moves it at high speeds, efficiently.

Let your Caterpillar Dealer show you how these rugged rigs can move material faster and cut costs in your operation. You can depend on him for sound advice now—for fast service and parts you can trust after you buy.

Caterpillar Tractor Co., San Francisco, Calif.; Peoria, Ill., U. S. A.

CATERPILLAR*

*Caterpillar and Cat are Registered Trademarks of Caterpillar Tractor Co.





Turning Tailings into Ore!



This NAYLOR spiralweld pipe is being used in dredging operations to convert tailings into ore.

It's another example of the heavy-duty service you can expect from this distinctive lightweight pipe. It's easy to handle. Extra strong. Installs faster with the one-piece NAYLOR Wedgelock coupling. Sizes from 4 to 30 inches in diameter.

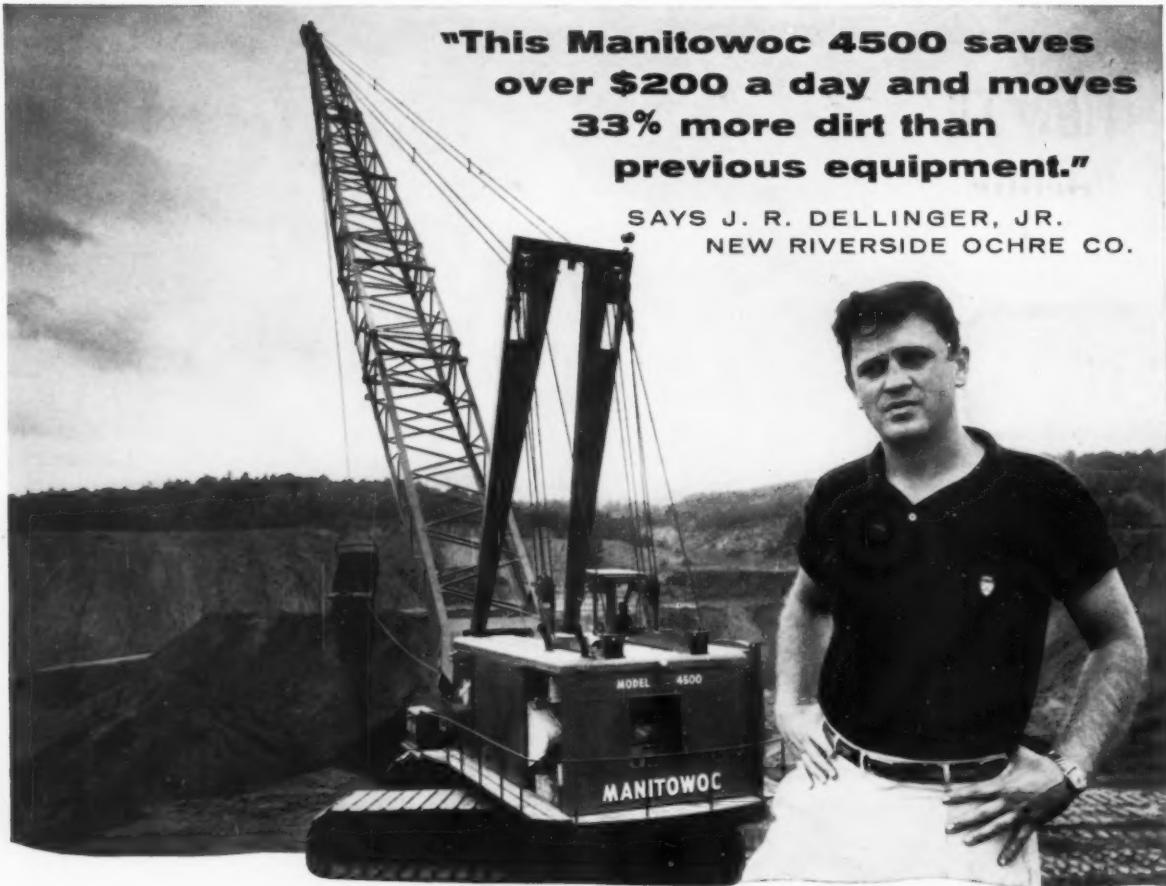
Write for Bulletin 507 which tells the complete story.



1242 East 92nd Street, Chicago 19, Illinois

Eastern U.S. and Foreign Sales Office • 60 East 42nd Street, New York 17, N. Y.

NAYLOR



"This Manitowoc 4500 saves over \$200 a day and moves 33% more dirt than previous equipment."

SAYS J. R. DELLINGER, JR.
NEW RIVERSIDE OCHRE CO.

The New Riverside Ochre Company, Cartersville, Ga., increased the output of barite ore by one-third after putting a Manitowoc 4500 dragline to work in the company's open pit mine. "In addition, the 4500 easily saves us \$200 a day in labor and operating costs," says Mr. James R. Dellinger, Jr., partner in the operation.

2400 Yds. per shift

The overburden runs between 30' and 65' deep. Equipped with a 140' boom and 4½-yd. bucket, the 4500 first strips the overburden then excavates and stockpiles the ore for weathering. A week later the ore is shovel-loaded into trucks for washing and breaking. Present output is running about 2400 yards per 8-hour shift. Before the Manitowoc 4500 came on the job, output was limited to 1600 yards each shift, excavated by two shovels — a 1½-yd. and a ¾-yd. unit.

Saves \$200 a day

Use of the big 4500 has cut labor and operating costs by more than \$200 a day. The drag handles a yard of dirt for 7 cents, compared to the 25 cents a yard with the old, two-shovel method — a saving of \$230 a day, *plus* the increase in production! With the ore running 75 to 100 feet deep, the Manitowoc's lower cost per yard of material moved allows the company to mine at extreme depths and still show a profit.

Selective Mining Possible

Because of the Manitowoc's long reach and accurate control, selective mining is now possible — casting off the overburden to one pile and ore-bearing earth to another. Thus, the grade of ore obtained from "spotty" areas intermingled with overburden is improved. The shovels used previously could not economically reduce the amount of dirt mixed with ore.

Single Power Package

The Manitowoc 4500 offers big capacity with all the advantages of a single diesel power package. You get greater simplicity, more efficient utilization of power and more mobility. Unit drive eliminates involved electric motors, control boards, miles of wiring and the deadweight and wasted space this equipment requires. There's no restrictive cable dragging from the machine to prohibit mobility . . . no expensive power installations anywhere. The 4500 follows the ore to any spot on your mine.

There's much more to the profitable Manitowoc 4500 story. See your Manitowoc distributor for complete information on this amazing mining machine!

MANITOWOC ENGINEERING CORP., MANITOWOC, WIS.

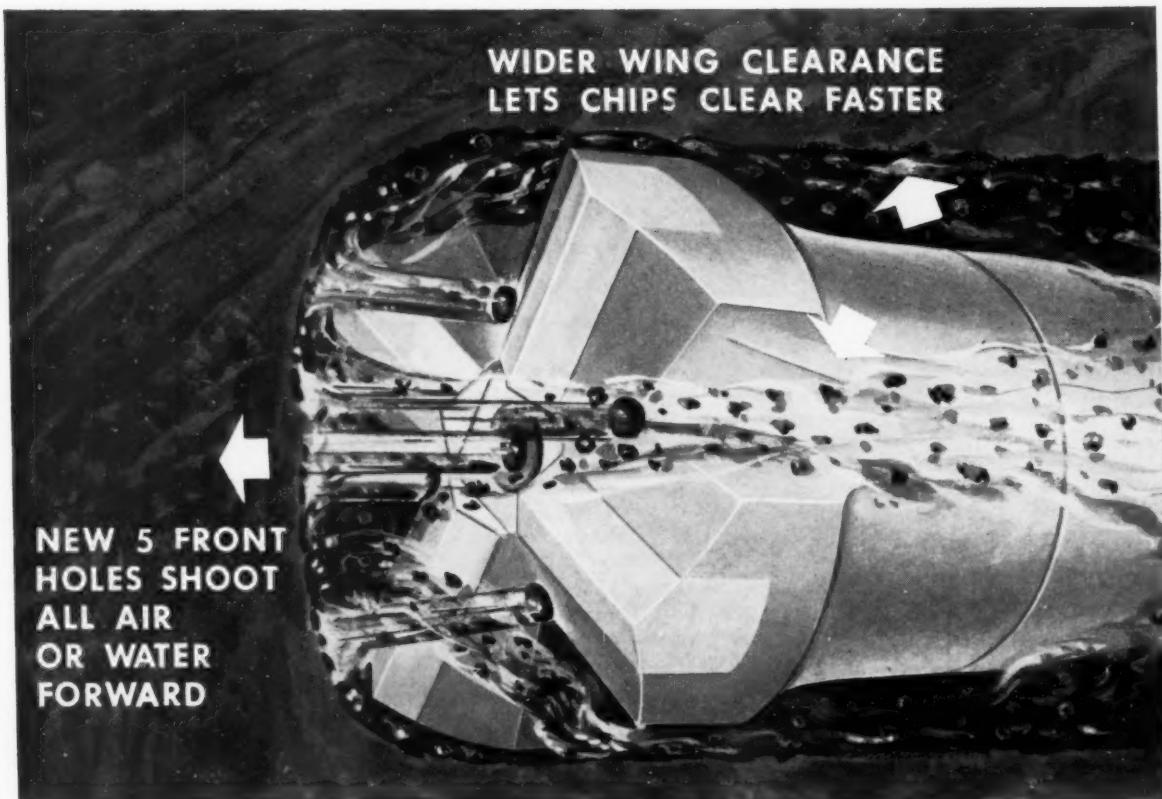
**SHOVELS
1-5½ YD.**

Manitowoc

**CRANES
20-100 TON**

For drifters, sinkers and stoppers...

New TIMKEN® threaded bit spends less time "drilling" chips, more time drilling rock



The diagram above shows how the new Timken® threaded carbide bit spends less time "drilling" chips and more time drilling rock—gives you more hole-per-bit. That's because 1) the new Timken threaded carbide bit's newly positioned 5 front holes direct all air or water with jet-action against the rock face and 2) the deeper, wider wing clearance lets chips clear faster. And the deeper relief under the heel allows even more clearance for washed-back chips. This speedier chip removal ends the problem of clogged drill steels and protects bit skirts against damage.

You save even more because new special analysis carbides in the new Timken threaded bit give it greater

wear-resistance with added shock-resistance. They can be reconditioned many times. The redesigned heavier wing helps drilling go faster. And the improved thread contact cuts breakage to the lowest point.

For more hole-per-bit on drifters, sinkers and stoppers, use the new Timken threaded carbide bit. Write for free brochure that gives all details. The Timken Roller Bearing Company, Rock Bit Division, Canton 6, Ohio. Cable: "TIMROSCO".

FOR OTHER TOUGH DRILLING JOBS



IMPROVED TIMKEN
MULTI-USE BIT

with correct, controlled reconditioning, gives lowest cost per foot-of-hole when full increments of steel can be drilled.

NEW TIMKEN
TAPERED SOCKET BIT

The air-leg bit of the future—here today! Removable for full steel life. Tapered for more secure union. Same new frontal features as threaded bit.

TIMKEN

TRADE-MARK REG. U.S. PAT. OFF.

REMovable ROCK BITS

Right off the *Wire*

An all-electronic telephone exchange (said to be the first for commercial use) has no moving parts, is noiseless and can be used in explosive atmospheres. It includes a "memory" which will hold an incoming call.

&

Wire can be strung beside a railroad track by a new travelling crane at the rate of 60,000 feet per hour.

&

Simplex recently completed one of the largest and heaviest shipments of cable ever transported on one reel — nearly two miles of ANHYDREX XX insulated submarine cable weighing 60 tons.

&

A new rubber-like material is porous, but will contain liquids.

&

Boron, lithium, hydrogen peroxide and fluorine compounds are to be the fuels of a new bomber reported to be in the design stage.

&

Smog-causing chemicals from automobile exhausts can be eliminated by a chemical catalyst developed by an automobile manufacturer.

&

Improvements in the explosive rivet have made it noiseless.

&

Only the touch of a hand is needed to light a new lamp. The electricity in the hand does the work.

&

Thorium is about three times as plentiful as uranium. A new process for the production of reactor-grade thorium should lead to a reduction in the cost of atomic fuel.

&

A high-output ultraviolet lamp, for heating and air-conditioning ducts, is claimed to be 1,000 times more effective in killing viruses and bacteria than an equal amount of radiation from the sun.

The world's largest solar furnace is to be completed in 1959. It will produce temperatures as high as 8,000°F, which is about 70% of the temperature of the sun's surface.

&

An ultra-hard glass has been developed that retains its hardness up to 1508°F.

&

The cost of converting sea water to fresh water has been reduced from \$1.50 to 60 cents per thousand gallons.

&

"Talk-back TV", a new advance in educational television, enables a pupil to ask questions of a teacher who is broadcasting from a distant room.

&

Scientists have been able to produce shock waves with speeds of more than 100,000 mph (above Mach 150) involving temperatures higher than 100,000°F.

&

Some 1958 automobiles are using aluminum instead of copper in battery cables.

&

The first deep sea telephone cables to utilize the revolutionary new Bell Laboratory vacuum tube repeaters were manufactured by Simplex. Minimum tube life is expected to be 20 years.

&

Danish trawlers are using nylon propellers. The four-foot, three-bladed size weighs only seventeen pounds and they reduce vibration, resist impact damage and corrosion.

&

A cell that generates electricity by the chemical action of oxygen and hydrogen has been announced. It avoids some of the disadvantages of both dry cells and storage batteries.

&

An airplane has been built which can change its shape while in flight for the purpose of testing aerodynamic configurations.

C-L-X (Sealex) is the name of a new, completely sealed, corrugated metallic cable sheath manufactured by Simplex. It is pliable, moistureproof, and permits cable engineers to select the most economical cable cores, while assuring the greatest mechanical protection available.

&

Observations of the aurora during the Geophysical Year show that it occurs simultaneously at both the North and South Poles. This definitely identifies it with the earth's magnetic field.

&

A miniature battery about the size of a paper clip is said to deliver a steady flow of current for 176,000 hours.



Shirtsleeve Service

Simplex recently completed an order for 4600 ft. of Anhydrex XX Parkway Cable. The Simplex man was on the spot to help with installation, which happened to be on a 9,500 ft. mountain in rough terrain. He helped design a reel mounting bracket (for holding up to 7200 lbs.) for the front of the tractor used for laying. He supervised the laying of two lengths 2200 feet long.

This case typifies the kind of cooperation that Simplex offers in order to assure correct installation and satisfactory service.

SIMPLEX WIRE & CABLE CO.
Cambridge, Massachusetts and
Newington, New Hampshire

Simplex

Highest quality cables for: Mining
Power & Lighting • Construction
Transportation • Communications
Signalling

See us at Booth 1124 Plant Maintenance & Engineering Show, Chicago

How rubber-tired mobility speeds pit production — increases profit

Only a rubber-tired tractor can readily travel from job-to-job in your pit or plant operations. It runs at speeds to 17 mph, shuttles fast between shovel clean-up and other assignments. The operator just shifts into high gear and your tractor is on its way, via haul road or across the pit floor to its next job, whether to strip overburden, level stockpiles, tow other equipment, or switch railroad cars.

Larger pit areas, and higher production requirements, make it necessary to have equipment that can move around fast and easy on its own power.

So the need for high-speed mobility is increasing each year, while the time and cost of moving track-type equipment designed for limited area work becomes higher and higher, cutting profits more and more.

In the light of these developments, it will pay you to consider the importance of *mobility* as a necessary tractor requirement in your pit operations.

Get all 4 . . . power, traction, speed and mobility . . . with Tournatractor®

Tournatractor is a modern tractor designed to provide ample *power, traction, speed* and *mobility* for scattered pit operations. It does not offer as much drawbar horsepower at speeds below 2 miles per hour as do track-type tractors of equal engine horsepower. But for pit operations where you *can* capitalize on *speed and mobility* — we suggest you consider the *new* Tournatractor. The cost is 10% below that of track-type tractors with torque converters and comparable engine horsepower . . . and maintenance costs are lower.

There's a bonus-value for you in today's improved Tournatractor. A railroad coupler attachment is now available, converts this machine quickly to a practical SwitchTractor*. With coupler at one end, and dozer at the other, unit does double-duty . . . makes it an even more profitable tool for your pit operations. Your LeTourneau-Westinghouse Distributor will be happy to send you more information on how Tournatractor *speed and mobility* can benefit your work. Or if you prefer, write to the LeTourneau-Westinghouse Company at Peoria, Illinois, U.S.A., for additional data.



Rubber-tired tractor travels at speeds up to 17 mph on work-and-run assignments. Operator can drive over pit floors, or off road. He can road his machine over tracks, ties, switches, and paving, without damage.



Sketched lines show range of rubber-tired tractor in typical mine. In foreground, tractor cleans-up around shovel. It ranges over entire pit floor for dozing, and on benches bordering the pit. Rail-head is only a few minutes drive away for switching work.

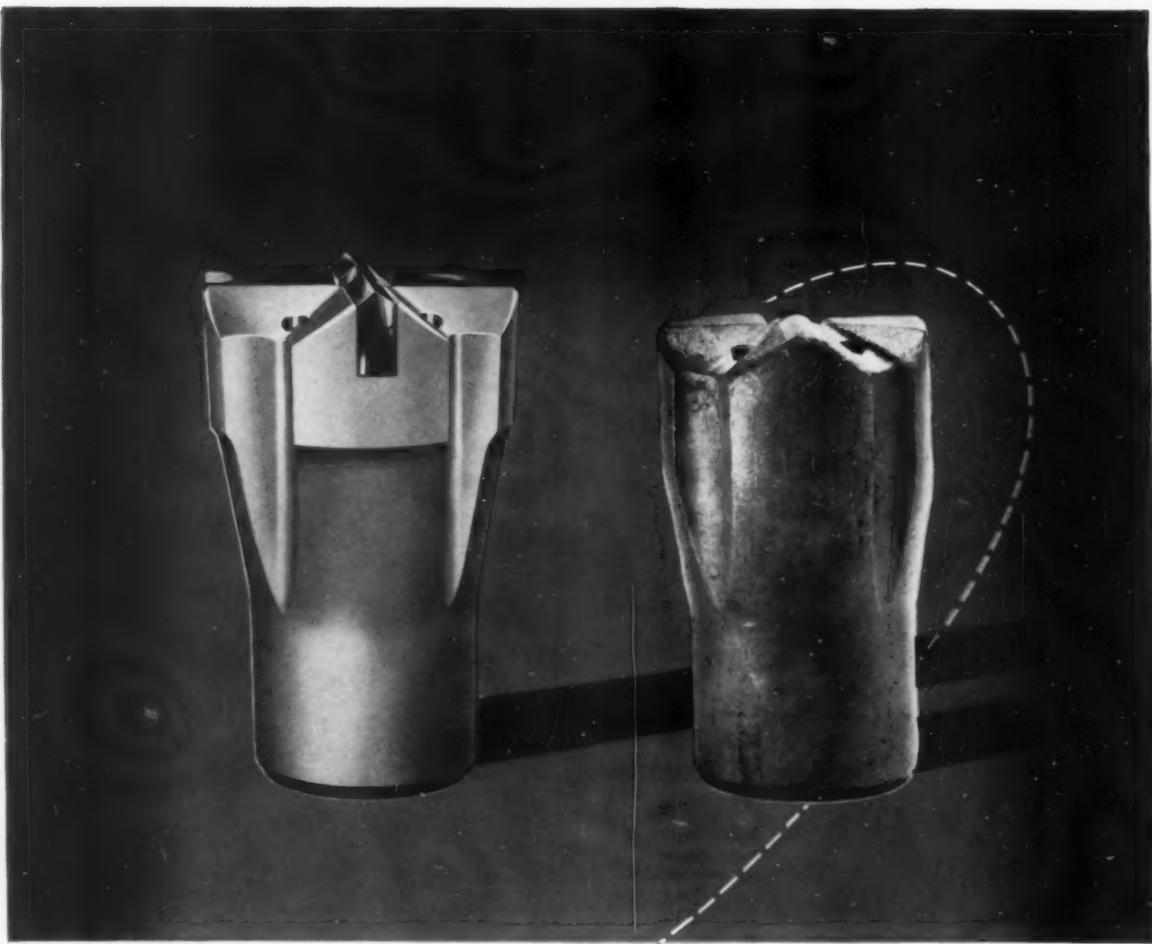
*Trademark CT-1614-M-1r



LETOURNEAU-WESTINGHOUSE COMPANY, PEORIA, ILLINOIS

A Subsidiary of Westinghouse Air Brake Company

Where quality is a habit



THIS JOY BIT DRILLED 1000 extra feet of hole

YOU'LL FIND YOUR BIT SIZE IN THIS CHART

SHOULDER DRIVE	BOTTOM DRIVE	TAPER SOCKET
1½"	2½"	1½"
1½"	2½"	1½"
1¼"	3"	1½"
1½"	3½"	1½"
2"	3½"	1¼"
2½"	4"	
2¼"	4½"	
2½"	5"	
2½"	4"	
2½"	4½"	
3"	5½"	
3½"		
4"		
4½"		

NOTE: Orange shade indicates x-type.
Black shade indicates 6 point rose design.
Others are cross type.

The real test of any tungsten carbide bit is—*how far does it drill?* The pictures above show a Joy bit before and after it drilled over 1900 feet of hole.

On a New England dam job, all other tungsten carbide bits had averaged 950 feet. Joy bits doubled this footage . . . averaged 1900 feet . . . gave the contractor a 2 to 1 advantage. (Particulars on request.)

You, too, can boost your bit footage and cut costs substantially with Joy Tungsten Carbide bits. Their offset wings, deep-slotted chipways, precision-milled threads, new brazing technique, long-lasting carbides and special alloy steel bodies make the difference. These features assure you of longer bit life and lower cost per foot of hole.

Get complete information from **Jay Manufacturing Company, Oliver Building, Pittsburgh 22, Pa.** In Canada: **Jay Manufacturing Company (Canada) Limited, Galt, Ontario.**

WSW M6B21-198

JOY

EQUIPMENT FOR MINING . . . QUARRYING . . . CONSTRUCTION



PORTABLE
COMPRESSORS



WAGON
DRILLS



TUNGSTEN CARBIDE
ROCK BITS



HAND-HELD
ROCK DRILLS

WRITE FOR FREE
BULLETIN 198-8



Do you want to reduce hauling costs?



How 15-speed motor grader can help your haulers make more trips every day

You will reduce the cost of hauling, increase pit output every day, by hauling at higher speeds. Faster haul speeds are practical *only* when your pit floor, benches, and haul roads are kept clean, smooth, and well drained. The better your surface, the faster you can haul, the more trips you can make per day, the lower your pit-haul costs.

To keep your haul routes in good condition you need motor graders that can do maximum work. You need machines that can make heavier cuts, push bigger loads, work and travel faster, machines that can always work in tough materials at near full power. This requires a wider range of more selective gear-ratios than most graders afford.

More speeds for full-power work
Only Adams 80 to 150 hp graders give you the extra work speeds you need. They provide 8 standard speeds forward and 4 reverse, plus 3 creeper gears (optional). That is 15 speeds in constant-mesh transmission.

For building and maintaining haul roads, ditching, and cleaning up at pit, plant, and stockpile, the Adams grader provides 4 forward working speeds. Other graders with 6 forward speeds have only 3 working gears, often cannot develop full push-power at the faster speeds that are correct for the job.

An Adams grader's 2 intermediate

gears, 10 and 14 mph, are useful for light, fast blading, snow plowing, maneuvering and climbing difficult grades. And travel speeds to 26 mph save time between grading assignments, time that can be used for extra blade-work.

Up to 30% more cycles on one-way grading

Most graders have only 2 reverse gears, about 3 and 7 mph. Adams graders have 4 reverse speeds, 2 for working, 2 for backing up fast. Adams graders' fastest reverse speeds (8 and 13 mph) prove very profitable. Often your operator works a 200', 400' or longer stretch, that is too short or too confined to make 180° turns worthwhile. Instead, he backs up. The Adams grader makes the reverse trip fast, converts usually wasted travel time to productive use.

Creeper gears for precise grades

Three optional creeper speeds, 31' to 160' per minute (full power, 0.41 to 1.82 mph), afford a means to concentrate full engine power for ripping up and regrading old roadways, pioneering for exploration and new roads, clearing overburden of stumps and roots and working through rocky ground. They eliminate overuse of the clutch to obtain maximum power at slow speeds, and therefore reduce clutch wear. Creepers also help you to grade more accurately, and to work in confined areas.

190 hp POWER-Flow 660

For maximum push-power *at all speeds*, Adams POWER-Flow Model 660 with torque converter gives you the effective work-power of an *infinite* number of gear ratios, from 0.0 mph to 27.4 mph forward.

Any one of the 6 Adams grader models (190, 150, 123, 115, 85, 60 hp) will handle more work for your investment. There is a size to fit your grading problems in any type of pit and plant situation. We shall be pleased to send you more information on receipt of your request.



Adams graders can handle more of your type of jobs, save time and money with efficient interchangeable attachments. These include: Scarifier for ripping-up old roadways and rock-filled soil, bulldozer for spreading and casting dirt and road materials, snow equipment for clearing roads, push-plate for push-loading scrapers and starting balky haulers.

POWER-Flow, Adams—Trademark G-1626-MQ-1r



LETOURNEAU-WESTINGHOUSE COMPANY, PEORIA, ILLINOIS

A Subsidiary of Westinghouse Air Brake Company

Where quality is a habit



YOU CAN'T BARGAIN WITH SAFETY

Lifting heavy beams for steel-skeletoned skyscrapers, over the heads of pedestrian and vehicular traffic, calls for careful loading — with safe slings, stout wire rope and a crane that's securely guyed with steel cables. Structural steelworkers practice safety because they know that ...

life depends on it

Today, taller buildings, bigger bridges, deeper oil wells, greater construction projects require stronger, safer wire rope. And equipment operators know that when you buy "bargain" rope you're heading for headaches, trouble and expense. So don't bargain with safety. Buy wire rope on the basis of *quality*. Buy Wickwire Rope.



LOOK FOR THE
YELLOW TRIANGLE

PRODUCT OF WICKWIRE SPENCER STEEL DIVISION
THE COLORADO FUEL AND IRON CORPORATION

THE COLORADO FUEL AND IRON CORPORATION—Albuquerque • Amarillo • Billings • Boise • Butte • Denver
El Paso • Farmington (N.M.) • Fort Worth • Houston • Kansas City • Lincoln (Nebr.) • Odessa (Tex.) • Oklahoma City
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5696

Load-out more per shovel

Tournapull Rear-Dumps
reduce loading time,
handle more
loads per day



You will load-out more per day, when your shovels load into LeTourneau-Westinghouse Tournapull Rear-Dumps. These sturdy haulers speed your load, haul, dump, and return cycles in many ways. Here is how Tournapull Rear-Dumps increase production by saving time in the loading zone.

Faster positioning at shovel

The Tournapull Rear-Dump eliminates slow maneuvering to position, while your shovel remains idle and waiting. The Tournapull operator can turn the prime-mover 90°, to maneuver quickly into the best loading position. Tournapull's quick maneuverability adds time for extra payloads, saves preparation of turn-arounds, shortens cycles.

Turns 180° in tight quarters

The Tournapull can make fast, short-radius, 180° turns at the shovel, in

narrow pits, or in tunnels. This frequently eliminates delays for shuttling into small areas. A 22-ton Model C Rear-Dump, for example, can turn 180° in a space less than 21' wide. All LeTourneau-Westinghouse haulers make continuous 180° turns in less than their own length. With body in dump position, they can turn in 25% less than their length.

Big, easier-loading bowl

The Rear-Dump's broad bowl is an easy target, one that lets your shovel operator position the dipper fast, for a quick dump without spillage. He swings the bucket through the bowl's low rear entry in a smooth arc.

The rugged body is so tapered that it withstands shock loads easily. Material is channeled to quickly

build a protective load cushion in the bottom. Because the long driveshaft is eliminated, the unit also gives you an exceptionally low center of gravity for safe, fast hauling.

Steady, low-cost earthmoving

Tournapull Rear-Dumps are quickly loaded to capacity, maneuver easily, haul steadily on or off roads, and dump clean in seconds. They are easy to operate and especially safe for work on soft fills, on steep hills, on narrow winding roads, or when dumping over banks. The Tournapull's simple construction reduces maintenance and downtime.

Write us for complete details on these high-production LeTourneau-Westinghouse Rear-Dumps.

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R-1461-DC-1r



**Exclusive
Tournapull steering**
Only Tournapulls give you geared, electric-powered, 90° kingpin steer. At the touch of a dashboard switch (or movement of the steering wheel on the 35-ton unit) the prime-mover pivots on the kingpin. A safety limit switch stops turns at 90°.

Three profit-building sizes			
	Model B	Model C	Model D
Ton Capacity...	35 net tons	22 net tons	11 net tons
Bulk Capacity... (hoisted 1:1)	31 cu. yds.	22 cu. yds.	10.5 cu. yds.
with tailgate	33 cu. yds.	24 cu. yds.	11 cu. yds.
with sideboards ...	not offered	28 cu. yds.	not offered
with tailgate and sideboards ...	not offered	29 cu. yds.	not offered

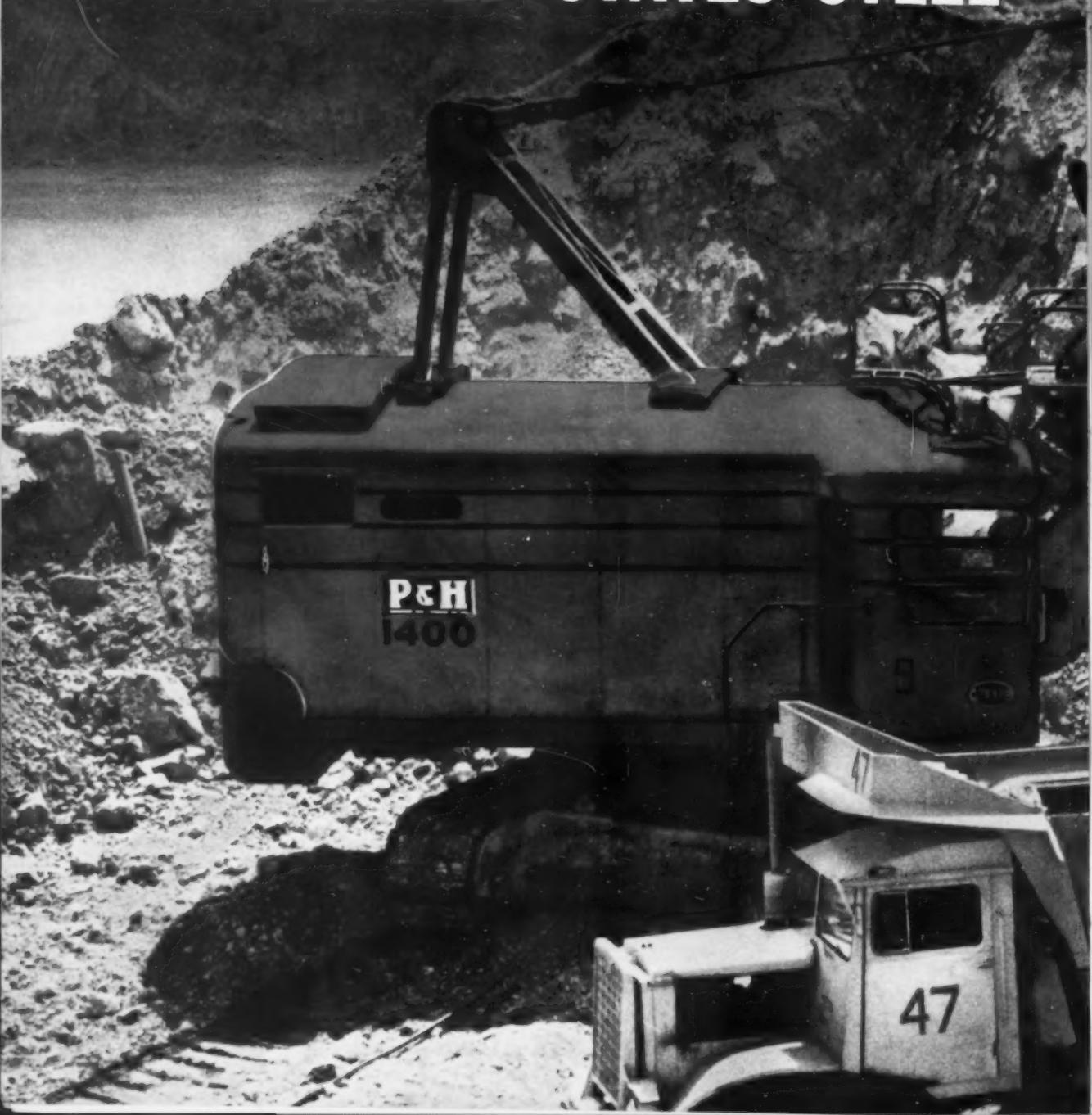
LETOURNEAU-WESTINGHOUSE COMPANY, PEORIA, ILLINOIS



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Where quality is a habit

ALONG THE P&H ELECTRICS ARE WORKING FOR UNITED STATES STEEL



UTAH RANGE



In their iron mining operations in southern Utah, United States Steel's Columbia Iron Mining Company is using *three* P&H 1400 Electrics. You will find P&H Electrics delivering dependable production in mining operations throughout the world.

P&H performance is the result of these exclusive P&H designed and manufactured features:

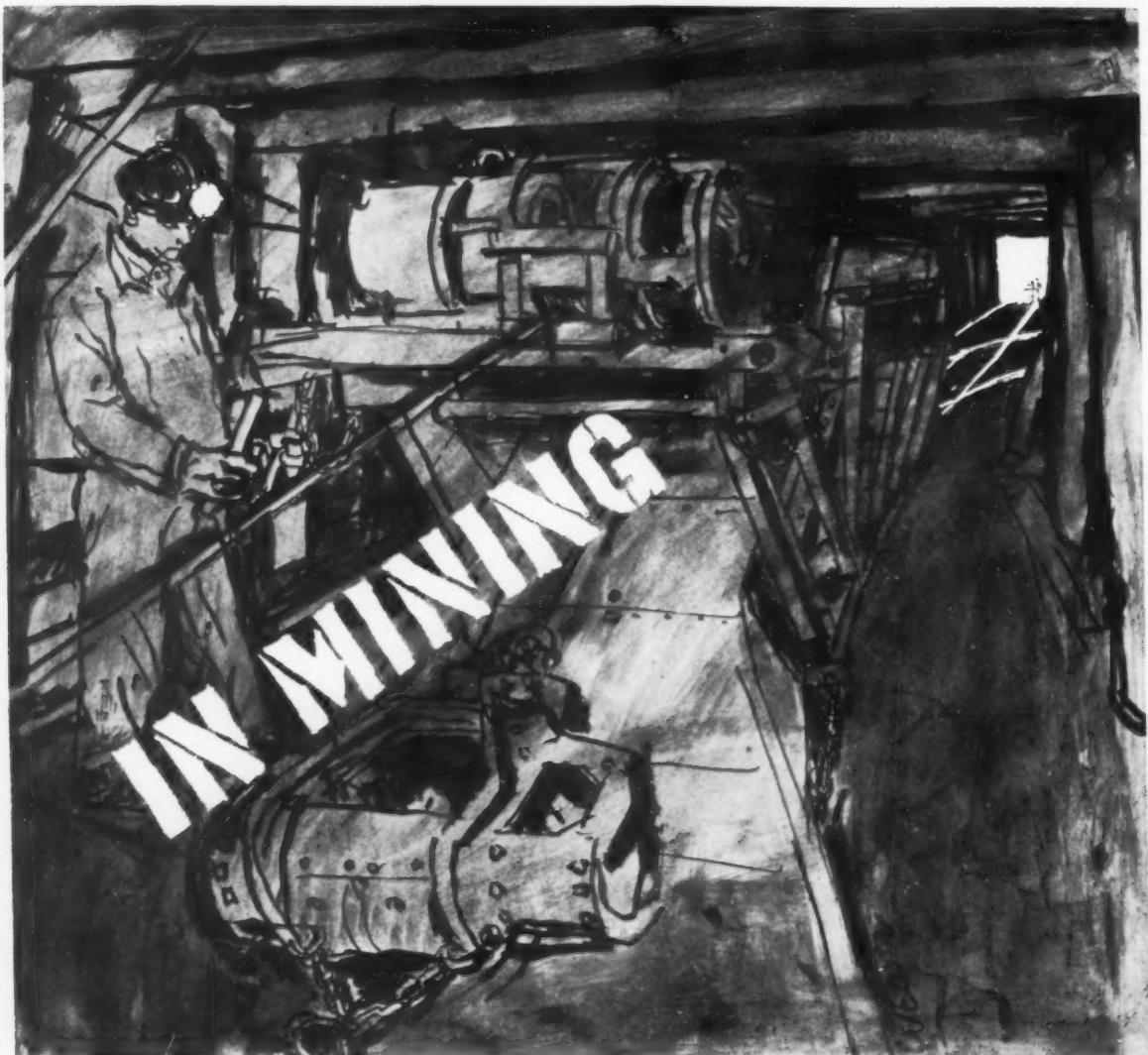
MAGNETORQUE®...transmits power from the hoist motor to the dipper electro-magnetically for fast action and at the same time, eliminates shock and impact to the hoist gear train and motor. Response is immediate to varying load conditions.

ELECTRONIC CONTROLS . . . P&H designed and built to provide fast action. All motions are smooth, resulting in consistently high output.

It will pay you to choose from the complete P&H line. P&H Electric Shovels from $3\frac{1}{2}$ through 10 cu. yds., P&H power shovels from $\frac{1}{2}$ through 4 yds., truck cranes from 10 through 60-tons. In addition, P&H offers single source service responsibility.

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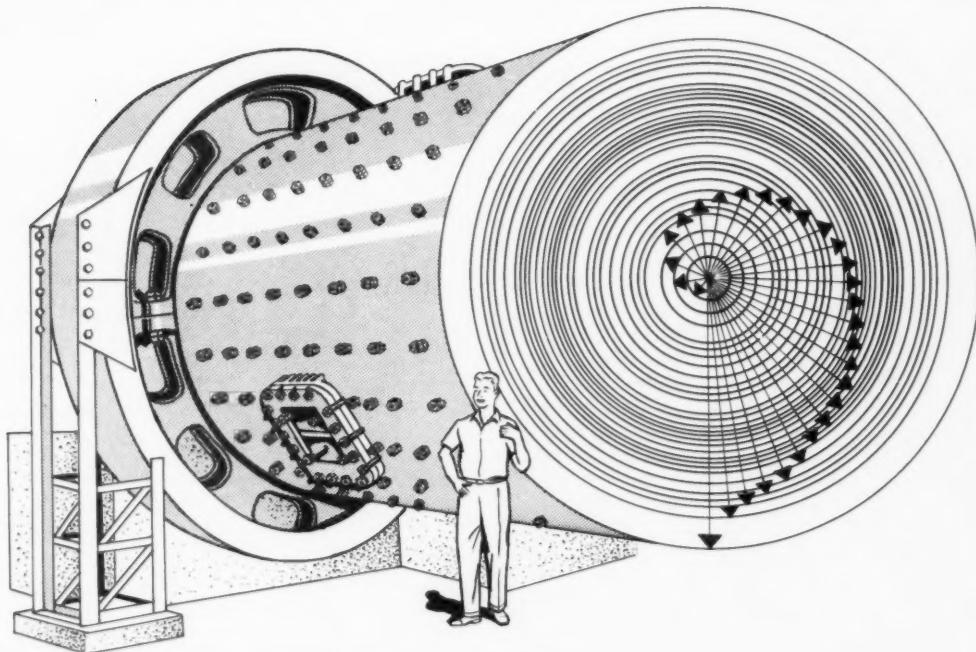


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29 different diameters



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Small or large, all Marcy Mills incorporate the same experience and proved performance . . . and, regardless of the size mill you require, Marcy's extensive manufacturing facilities assure you that it will be properly and most economically built.

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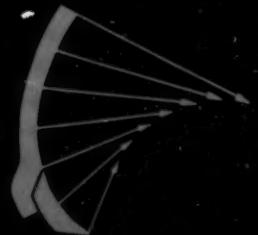
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**THE ROLL-AWAY MOLDBOARD
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of bits for all soft-
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A Cone-Type Rock Bit . . . for Oil and Minerals Exploration and Quarry Blast Hole Drilling . . . is now included in the Hawthorne "Blue Demon" *All-Formation* drill bit line.

Designed for drilling harder formations than are regularly recommended with the patented "Blue Demon" Replaceable Blade Bits, the Cone-Type Rock Bit is available from authorized Hawthorne dealers in $3\frac{7}{8}$ ", $4\frac{1}{4}$ ", $4\frac{1}{2}$ ", $4\frac{3}{4}$ " and $5\frac{5}{8}$ " sizes.

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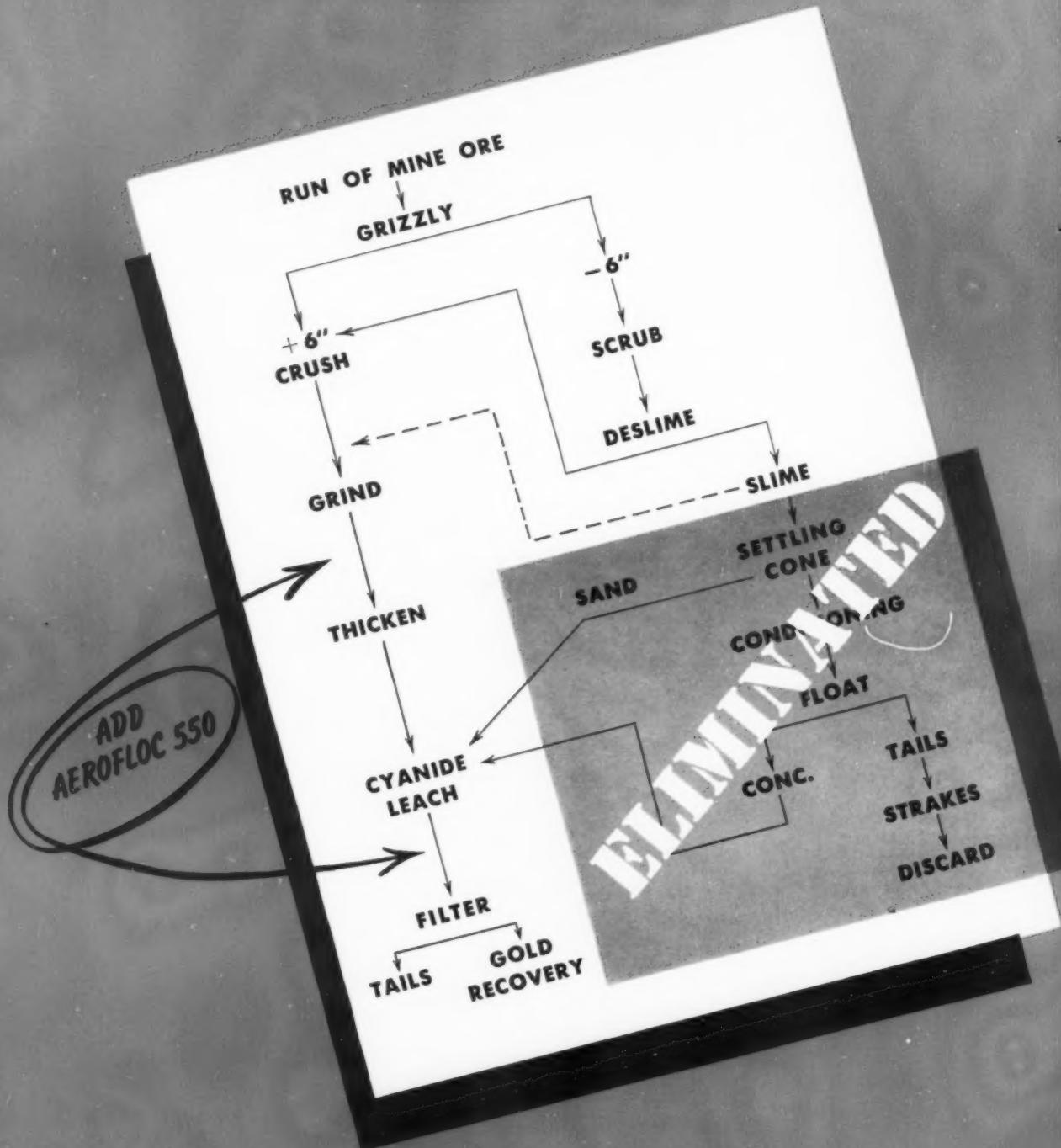


MARIONS IN COPPER

This is one of more than 40 Marion machines at work for one owner in one of the biggest producing copper mines of the world. It is a 7 yard Marion 151-M, designed for continuous service in the world's heaviest digging.

MARION POWER SHOVEL CO. • MARION, OHIO

PHILIPPINES GOLD PRODUCER FINDS AEROFLOC



550 REAGENT AN EXCELLENT SLIME CONTROLLER

**Only 0.01 lb/ton increases gold recovery by 1.3% . . .
Simplifies flow scheme by eliminating slime flotation**

Every pennysworth of AEROFLOC 550 Reagent used at Baguio Gold Mining Company increases recovery by approximately 10 cents and eliminates slime flotation, too! Here's the step-by-step background of this interesting, profitable beneficiation development.

Baguio Gold treats 450 tpd of gold ore running 0.23 to 0.25 oz Au/ton by straight cyanidation with AERO® Brand Cyanide. Ore consists of gold with pyrite and some chalcopyrite in quartz-calcite veins in andesite and diorite.

Following its destruction during World War II, the 1933 mill was re-built in 1952. Primary slime trouble required the addition of a washing plant in 1954 to segregate 30 tpd of slimes running 0.25 oz/ton for treatment by froth flotation using AERO® Xanthates and pine oil. The concentrate was added to the grinding and cyanidation circuit and the slime tailing was discarded after straking. The exclusion of slime from the cyanidation circuit was an important factor in reducing cyanide consumption from 1.5 to 0.6 lb/ton.

In 1956, the experimental use of various AEROFLOC Reagents showed that flotation feed could be cut to 20 tpd with an increase in recovery of values in the flotation feed from 75% to 85%. Cyanide consumption held steady. In 1957, slightly increased dosage of AEROFLOC 550, fed as a 0.1% water solution to the thickeners ahead of the leaching circuit, made possible complete elimination of the slime flotation step. The whole ore is now cyanided with gain in gold recovery close to 1.3%, plus savings in power, reagents, labor and maintenance.

Such noteworthy gains are not always possible. But even in long-established flow schemes continued testing with the newer reagents can produce very worthwhile gains. Cyanamid Field Engineers stand ready to collaborate with mining companies in studying new and more efficient reagent combinations and other steps that might minimize costs-plus-tails.

CYANAMID

AMERICAN CYANAMID COMPANY
MINING CHEMICALS DEPARTMENT
30 ROCKEFELLER PLAZA, NEW YORK 20, N.Y.



1957 has been a year of contrasts.

Significant advances in technology, the completion of a substantial portion of our program to expand our productive capacity in the U. S. and Canada and the strengthening of our marketing organization are all tangible achievements which will bring us both immediate and long-term benefits. On the other hand, a generally lower activity in new projects coming in has emphasized the narrowing profit margins faced by most businesses and points up our insistence on improving designs, reducing costs and increasing efficiencies.

A broad, the picture is bright. Our subsidiaries report current high levels of business and there is great optimism for the future. Of particular interest is the success of our newest family member, Dorr-Oliver Pty. Ltd. of Australia, which opened its doors on January 1 of this year and by mid-year had far surpassed expectations. Growth of Dorr-Oliver (India) Ltd., another of our newer associates, has also been noteworthy, with the recent addition of local manufacturing facilities justifying still greater optimism.

SUGAR — In 1957 a total of 42 RapiDorr Clarifiers and 48 Oliver-Campbell Cane Mud Filters were sold to the cane sugar industry. A significant aspect of this outstanding record has been the increasing participation of our subsidiaries and representatives abroad. They are locally manufacturing, in some instances for the first time, 31 of these machines in Argentina, Brazil, England, France, Germany, India, the Philippines and South Africa.

POLYETHYLENE — The first Merco Pressure Centrifuges went into operation early last year removing catalyst from liquid polyethylene at capacities considerably in excess of original expectations. Overseas, British, Italian and German producers ordered Pressure Centrifuges for similar application in both new commercial scale and pilot plants.

SANITATION — One of the highlights of the year was D-O activity in the waste water disposal field. Four major new developments — all ideally suited for smaller plants — were introduced. The SpiroVortex System which is a complete treatment process akin to activated sludge, the Degritting Clarifier and Clarigester and the DorrClone Classifier as applied to sewage dewatering have already been commercially proven at plants in the western U. S. First installations of the CompreCreator, a package plant to serve a population of 150, are now operating with some 30 additional units scheduled to start up in 1958.

Our subsidiary in the Netherlands has marketed equipment for facilities as far distant as Norway, Iraq and India, while new or enlarged D-O equipped domestic installations sold in 1957 can be found from New York City to Los Angeles and San Antonio, Texas to Fairmont, Minnesota.

GENERAL METALLURGICAL — Applications of the DSM Screen, first introduced in 1956, continued to grow in virtually every field we serve. One of the most promising has been magnetite recovery in heavy media cyclone plants on the Mesabi Range. Also new is the swing-type agitator for the American Filter — a development particularly applicable to filtration of heavy metallurgical slurries.

Following the trend noted in previous years, widespread acceptance of the Slurry Mixer by the cement industry and the Thickener — American Filter combination by the coal industry continued again last year. In Germany, France, India and Australia flue dust clarification and recovery contributed materially to our business and in Canada a substantial volume of Dorr-Oliver-Long shaft equipment and mine cars was purchased for underground mines.

PLANT ENGINEERING — At the year's end, design of a granular fertilizer plant for India and sections of a new Cuban nickel recovery plant were partially completed, and construction of three D-O designed phosphoric acid or fertilizer plants was progressing in Venezuela, England and Montana. During the year a 200,000 ton per year triple super-phosphate plant in Florida and a Norwegian phosphoric acid installation were put into operation and brought up to design capacity in near record time.

FLUOSOLIDS SYSTEMS — Also in the fertilizer industry two western producers ordered the first FluoSolids Systems to be used for calcination of phosphate rock. Designed to handle a total of 1,500 tons per day, these installations were the direct result of successful field tests using a portable fluidized bed pilot plant. During the year other FluoSolids Systems were ordered to dry limestone and blast furnace slag in the U. S., roast copper

matte in Belgium, calcine clay in Scotland, decompose copperas in England, and roast pyrite for a Japanese paper mill and an Italian sulfuric acid manufacturer.

The largest FluoSolids System for fine coal drying, handling over 600 tons per hour, went into operation during the third quarter at a new eastern preparation plant, and construction is nearing completion on a second similar, but smaller, installation. In the realm of unusual applications is a unit drying a highly-corrosive chlorinated hydrate at an eastern chemical plant.

WATER TREATMENT — In the southwestern United States the DorrClone Classifier has been used with notable success for the desanding of municipal well water supplies. For small plants the Perifilter System with a single pre-treatment unit and split filter provides economical centralized water treatment.

Major expansions of the Louisville, Kentucky and Fort Worth, Texas treatment facilities will be D-O equipped as will new municipal plants at Springfield, Ohio; Peoria, Illinois; and Delhi, India. New industrial treatment installations will serve pulp mills in South Carolina, India and Venezuela and an Indian fertilizer plant.

PETROLEUM — Another modification of the familiar DorrClone Classifier is the Clay-Jector, latest development for control of drill mud weights. Noteworthy economies are possible using this unit which mechanically rejects undesirable drilled solids while recovering valuable barites for reuse.

CHEMICAL — A substantial amount of D-O equipment of all types has been incorporated into the unique flowsheet of a new astrakanite recovery plant in the Chilean nitrate fields. In Germany and the United States, Horizontal Filters have been widely applied to dewatering and washing of fine organics as well as highly corrosive inorganics, and around the world filters of both standard and special construction were ordered for an almost endless variety of services.

COPPER AND URANIUM — Last year substantial amounts of D-O processing equipment were purchased for new and enlarged copper mills in South America, Mexico, the Belgian Congo and United States and new uranium mills in Australia, United States and Canada. A new and improved design and method of fabrication of stainless steel rake Classifier blades was developed. Although conceived initially for the uranium industry this design is broadly applicable to classifications involving corrosive solutions. Certainly no summary of 1957 accomplishments would be complete without mention of the Chemical Engineering Achievement Award presented last month to a group of companies including Dorr-Oliver for their contribution to extractive metallurgy of atomic age metals. Interestingly enough, D-O was one of the very few engineering equipment organizations selected for the award.

With several years of expansion and enormous activity behind us, the current business plateau provides a much needed opportunity to consolidate and catch our breath. The real challenge will be to increase the spread between income and outgo through more efficient operation — while accelerating the rate of our technological advances. I am confident we can, and will, do both.

J. D. HITCH, JR.
President
November 18, 1957

Mining World

THE IMPORTANT MINING MAGAZINE EVERYWHERE

January 1958

INTERNATIONAL PANORAMA

LAKEVIEW, OREGON—Lakeview Mining Company has secured a contract with the United States Atomic Energy Commission for the erection and operation of a 210-ton-per-day uranium mill here. This is first uranium mill in Oregon. Negotiations started months ahead of recent AEC mill freeze order.

LAKEHURST, NEW JERSEY—American Smelting and Refining Company has discovered a large deposit of ilmenite-bearing sands near here. The deposit is suitable for mining and concentrating similar to that already used for ilmenite beach sands in Florida.

PANAMA, PANAMA—Kaiser Exploration Company has secured an exclusive concession for bauxite in western Panama. Preliminary exploration has indicated extensive deposits.

BATESVILLE, ARKANSAS—American Potash and Chemical Company has secured control of 100,000 acres of manganese-bearing land from four small manganese producers. American Potash will explore the area.

ROTTERDAM, NETHERLANDS—The Iron Ore Company of Canada is building a trans-shipment station here to enable the firm to make major deliveries of Canadian ore to European steel mills.

MARBLE, MINNESOTA—Oliver Iron Mining Division of United States Steel Corporation is building a new spiral concentration plant at its Arcturus mine to recover 125,000 to 165,000 annual tons of fine ore concentrate which heretofore has been lost.

SHALLEE, EIRE—Cyprus Mines Corporation and Cerro de Pasco Corporation are seeking exploration and mining rights from Silvermines Lead and Zinc Company Ltd. Silvermines is the largest lead and zinc producer in Eire.

KINGSTON, JAMAICA—International Metals Limited has secured exclusive prospecting licenses for a 7,000-acre block in St. Andrew Parish. Development of iron and copper prospects is planned by the firm.

MASCOT, TENNESSEE—More than \$3,000,000 is currently being spent on exploration for zinc in eastern Tennessee. One half is from the Defense Minerals Exploration Administration and the other half by mining and exploration firms.

PAINESDALE, MICHIGAN—American Metal Company, Ltd. has developed an important new copper reserve by diamond drilling. Some 50,600,000 tons of copper-bearing shale averaging 1.52 percent copper and 54,400,000 tons averaging 1.04 percent have been developed.

PORTLAND, OREGON—Oregon Metallurgical Corporation has started delivery on 350,000 pounds of reactor grade zirconium to Westinghouse Electric Corporation for use in atomic reactors.

MIAMI, OKLAHOMA—The Eagle-Picher company has reopened 10 zinc-lead mines in the Tri State field here which were closed on July 31st by low metal prices.

CAPE YORK, QUEENSLAND—Development of the Cape York bauxite deposits has been started by Commonwealth Aluminium Corporation Ltd. Reynolds Metals Company and Aluminium Company of Canada Ltd. have formed subsidiaries to prospect and develop concessions and leases in the area.

RICHMOND, VIRGINIA—Metal and Thermit Corporation has opened its new 100-ton-per-hour rutile open-pit mine and concentrating plant in Hanover County. The new plant is scheduled to supply 12 percent of the United States rutile requirements this year.

NAKINA, ONTARIO—The Anaconda Company Ltd. (Canada) has exercised options to buy extensive low-grade magnetite deposits from the Lake Superior Iron Ore Company. A new company will be formed to explore and develop the deposits. This is the Anaconda Company's first iron mining venture.

Canadian Iron Ore Claims Purchased by Anaconda

With the acquisition of large undeveloped ore properties in the Kowkash mining district of Ontario, Canada, the Anaconda Company has expanded its mining activities to include iron ore. Through its Canadian subsidiary, Anaconda Company (Canada) Ltd., options have been exercised on 76 claims held by Lake Superior Iron Ltd., and several hundred held by the Jean Gourd et al Syndicate, for a total of \$10,000,000.

Extensive drilling and tests indicate a large body of low-grade magnetite ore that can be beneficiated into a 64 to 69 percent iron concentrate. Unofficial estimates place the ore reserve at 500,000,000 tons of 25 to 30 percent iron content. Research carried on at the Battelle Memorial Institute, Columbus, Ohio, has found no major impurities but it has not yet been decided whether pelletizing or sintering will be used for agglomeration.

The property, about 25 miles long and varying from one to four miles in width, is only 32 miles north of the nearest railway (Canada National Railway) and about 125 miles north of the nearest port, Nipigon, on Lake Superior.

Anaconda has announced no final plans for mining and marketing the ore. Facilities capable of producing 500,000 to 2,000,000 tons of concentrates annually are said to be under consideration but more test drilling is scheduled, as well as additional research on the ore's metallurgy.

The subsidiary company has agreed to make full payment for the property within 90 days from the start of production. Until then installments of \$20,000 a year are to be paid until October 1975, when the balance falls due.

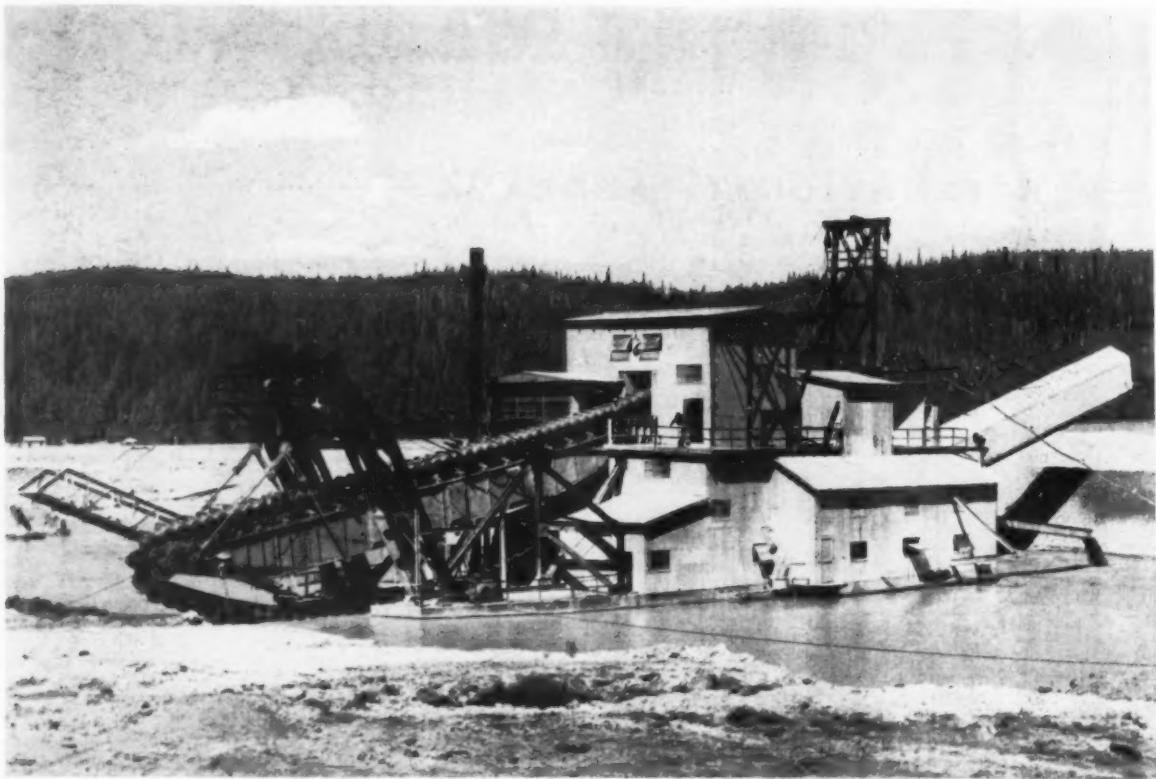
A new company is being formed to develop the property. Anaconda (Canada) will own 90 percent of the new firm, Lake Superior Iron, two percent, and the Gourd Syndicate, eight percent.

Kaiser Obtains Concession For Panamanian Bauxite

The first bauxite concession ever granted by the government of Panama has been awarded to the Kaiser Aluminum & Chemical Corporation's wholly owned subsidiary, Kaiser Exploration Company. The contract provides for exclusive exploration and mining rights in a large area of western Panama near the Costa Rican border.

In February . . .

How The Russians Do It—Mucking Out Behind The Iron Curtain



STRATEGIC MINERALS containing columbium, tantalum, and uranium are recovered by Porter Bros. Corporation dredges at Bear Valley, Idaho. Since practically all of our domestic re-

quirements of columbium-tantalum have been imported from abroad, this operation is of great importance. The above Yuba dredge contains 6-cubic-foot buckets.

Idaho Placer Is Source of 99 Percent Of U. S. Columbium-Tantalum Output

When Porter Bros. Corporation first pumped jig-concentrated black sands ashore from a dredge at Bear Valley, Idaho in 1955, it marked the start of one of the world's most unusual projects. It was the first time anyone had attempted commercial development of a placer for columbium, tantalum, and uranium.

The heavy mineral suite in the Bear Valley placer contains a group of minerals, termed "radioactive blacks", which are sources not only of columbium and tantalum but also of rare earths, thorium, and uranium. The predominant ore mineral is euxenite, a columbate and tantalate of the yttrium group of rare earths which also contains varying amounts of uranium. Substantial amounts of columbite $[(Fe,Mn)(Nb,Ta)_2O_6]$ and monazite are also present.

Because the minerals containing these strategic elements have a relatively high specific gravity (4.8 to 5.9), they are amenable to bulk, gravity concentration along with other black sands characteristic of placers. Two connected bucket-line dredges, a 6-cubic-foot and a 4½-cubic-foot unit, dig about 7,000 to 8,000 yards of gravel each day at Bear Valley. The gravels contain 20 to 130 pounds of total black sands per yard. Euxenite, columbite, and certain other minor minerals containing columbium and tantalum are found in amounts of 0.3 to 1.5 pounds per yard. The jig circuits aboard the dredges recover about 150 to 200 tons of black sand concentrate each day.

The dredge concentrate is treated at a mill at Lowman, Idaho, about 20 miles south of Bear Valley, by a combination of electromagnetic and high-

tension electrostatic means. Two main products are recovered—a columbite-euxenite concentrate and a monazite concentrate. Both concentrates are further up-graded by air tabling and wet tabling. The flow-sheet takes advantage of magnetism to scalp out magnetite and ilmenite. Columbite-euxenite and monazite are separated and partially concentrated by utilizing relative differences in conductivity. A complete report of the milling operation will appear in a forthcoming issue of *MINING WORLD*.

The columbite-euxenite concentrate is processed on a toll basis by Mallinckrodt Chemical Works yielding columbium-tantalum pentoxides, uranium oxides, a titanium residue, rare-earth residue, and a thorium residue. The columbium-tantalum pentoxides are sold to the General Services Administration under the stockpiling act.

The uranium oxide is sold to the Atomic Energy Commission. The monazite concentrate is sold by Porter Bros. Corporation directly to metallurgical processors.

Domestically Important

Last year Porter Bros. Corporation accounted for 99 percent of the domestic supply of columbium and tantalum. It operates the only dredging operation in the world established solely for the purpose of recovering strategic minerals containing these elements. For years the United States has imported over 99 percent of the columbium and tantalum requirements chiefly from Nigeria and the Belgian Congo.

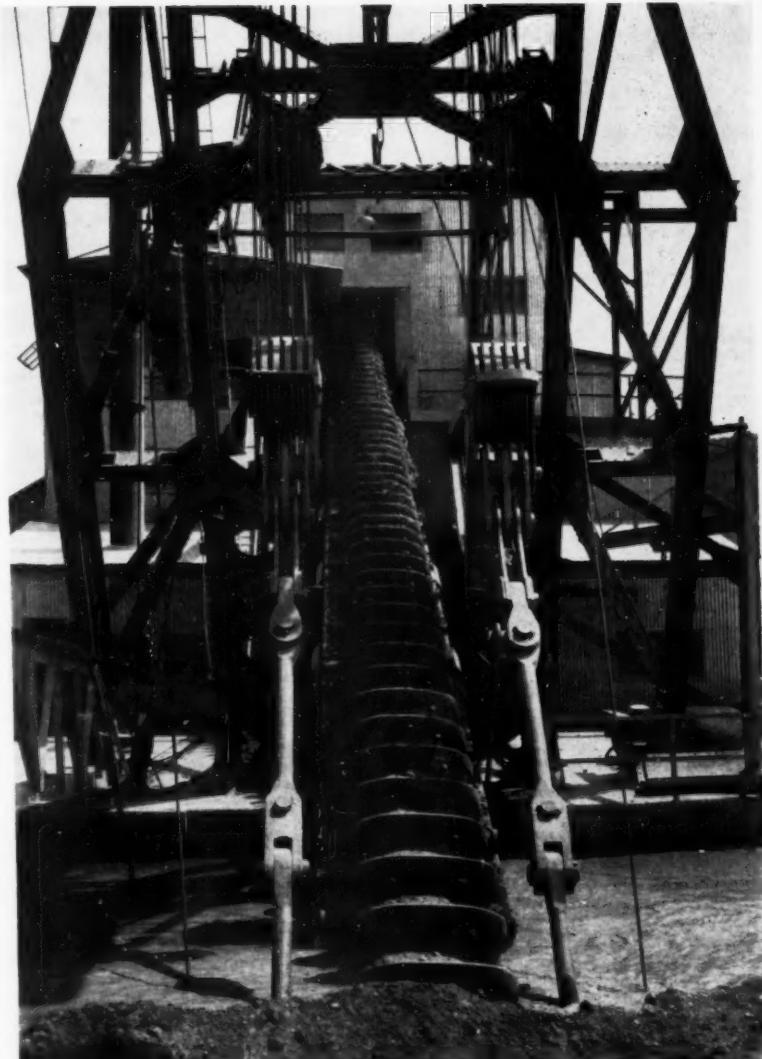
In Nigeria, columbite-tantalites are recovered as by-products from placer deposits worked primarily for cassiterite. In the Belgian Congo, columbite-tantalites are separated from tin concentrates recovered from open-pit pegmatites.

To an individual accustomed to gold dredging, the strategic mineral recovery program of Porter Bros. Corporation would seem strange. There has been little reconcentration of the black sands. Distribution of the blacks in the valley fill is erratic, often occurring in lenses. High-grade streaks are not necessarily found at the bedrock level. "Radioactive blacks" are just as likely to be found near the top as the bottom of the placer. Jigging on the boats must be carefully controlled because specific gravity differentials are small. The black sands with a density of 3.5 to 5.9 must be recovered from gravel averaging about 2.7 in density. The gold content of the Bear Valley deposits is very low.

A comprehensive research and development program was required to bring the deposit into production. Complex separation and beneficiation problems had to be solved by Porter Bros. Corporation. Mallinckrodt had to develop means for separating and recovering the valuable constituents of the complex minerals. Over \$3,000,000 has been poured into the Central Idaho project to bring it into production.

Igneous and Pegmatite Source

The Bear Valley placer deposits are located in the central part of the Idaho batholith. This is a large igneous intrusion composed of rocks varying in composition from granite to diorite. The country rock near the placer is a quartz monzonite, and it is cut by numerous pegmatite and aplite dikes. Monazite is a widespread but minor accessory mineral occurring in



IDAHO DREDGING OPERATION is only one in the world established solely to recover columbium and tantalum bearing minerals. Porter Bros. Corporation first became interested in the area in 1950 when it learned of discovery of radioactive deposits.

the granitic rocks of the Idaho batholith. Radioactive black minerals are known to be associated with pegmatites contained in the granite, but some question exists as to whether the pegmatites were the sole source of these minerals in the Bear Valley deposits. Though the mineralization was widespread, only locally did it occur in sufficient quantities favorable for concentration in placers.

Mineralogy

The following minerals are found with the black sands of Bear Valley: euxenite, monazite, fergusonite, brannerite, xenotime, columbite, ilmenite, magnetite, garnet, zircon, and ilmenorutile. The last five minerals are commonly associated with black sand de-

posits, and some are recovered as secondary by-products at the Lowman mill.

Monazite and xenotime contain chiefly rare earths, though some inclusions of the other minerals are present. The remaining ore minerals are termed radioactive blacks. Euxenite, smarskite, and fergusonite are columbates, tantalates and titanates of the yttrium group of rare earths containing uranium and thorium and some rare earths of the cerium group. Brannerite is an oxide of uranium and titanium, with small amounts of calcium rare earths, thorium, and iron. Columbite is a columbate and tantalate of iron and manganese. Ilmenorutile is a titanate containing some iron and manganese.

In the Bear Valley area, a typical

analysis of the placer deposits shows the following quantities of heavy minerals.

Euxenite	1.0 pounds per cubic yard
Monazite	0.5
Columbite	0.2
Zircon	0.05
Garnet	13.0
Ilmenite	28.0
Magnetite	7.0
	49.75 pounds per cubic yard

The composition of euxenite found throughout the world is widely variable. At Bear Valley, the Cb_2O_5 content of euxenite ranges from 23 to 29 percent; the Ta_2O_5 is 1.5 to 3 percent; TiO_2 ranges from 22 to 26 percent; and the $(\text{Y},\text{Er})_2\text{O}_3$ content varies from 24 to 28 percent. Columbite contains 56 to 72 percent Cb_2O_5 and 5 to 22 percent Ta_2O_5 .

The uranium and thorium content of euxenite is likewise quite variable in different localities of the world where the mineral has been identified. The Bear Valley deposits are blessed by a relatively high uranium content. Euxenite characteristically contains 2 to 16 percent U_3O_8 ; a fair average for the Bear Valley mineral is 8 to 10.5 percent. Thorium, expressed as ThO_2 , ranges from 2.5 to 5 percent.

Concentration Near Source

Topographically, Bear Valley is a broad, north-south trending, upland valley lying at an approximate elevation of 6,500 feet above sea level. Bear Valley Creek is one of the small

streams combining to make up the head waters of the Middle Fork and Salmon Rivers.

Due to favorable chemical and mechanical conditions of deposition, euxenite was concentrated relatively near its source. Inspection of the black sand fragments at Bear Valley, reveals corners that are only slightly rounded, indicating that the sand has not been transported a great distance.

Preliminary, early investigations led to the belief that local pegmatite and aplite dikes on the Bear Valley drainage pattern formed the source of the euxenite found in the placers. This contention was supported by the known association of radioactive euxenite with the dikes. Subsequent field work by J. Hoover Mackin and D. W. Schmidt, however, has disclosed pods or concentrations of high radioactivity in the quartz monzonite host rock at Bear Valley. The small pods vary in size from a few inches to a few feet in diameter. The distribution of the radioactive pods is far greater, however, near the borders of pegmatite dikes which occur in the granitic host.

Localization of the heavy mineral deposits at Bear Valley was controlled by: (1) the favorable distribution of these minerals in drainage slopes above the valley; (2) disintegration of the host rock sufficiently to free the heavy minerals; (3) the action of glaciers during the late Pleistocene which dammed the normal drainage and led to accumulation of valley fill; (4) quickened down-slope movement of enriched mantle during periods of glaciation. The largest zone of pegmatitic-aplithic facies occurs in a narrow band trend-

ing north-south along the southeast side of Bear Valley near the head of two creeks. The alluvial fans of these two tributaries to Bear Valley Creek are the richest portion of the valley fill.

Sand Lenses

In a report on uranium- and thorium-bearing placers in Idaho, J. Hoover Mackin and D. W. Schmidt state that changes in stream velocity accompanying seasons cause cycles of scouring and redeposition of alluvial materials making up the channel floor. Because the vigor of this process varies greatly from place to place in the channel, and because of sidewise shifting and changes in alignment of the channel, the deposit is an aggregate of lenses differing markedly in degree of sorting. The lenses of gravel may contain as much as 100 times the amount of heavy mineral content as adjacent lenses of sand. Though the authors were speaking of strategic mineral-bearing placers of central Idaho in general, the above condition was true in the Bear Valley area. The "radioactive blacks" are irregularly distributed in lenses from surface to bedrock.

The Bear Valley deposit has a reserve which compares favorably with some of the larger foreign deposits. The total foreign reserve in 1952 was 30,000,000 pounds. Porter Bros. Corporation has fully prospected sufficient area to indicate ore reserves for an operation extending for 30 years based on the present rate of production.

Dredges

Yuba Manufacturing Division, several years ago, had built two, connected, bucket-line dredges on pontoon hulls for Porter Bros. Corporation. These dredges were used in the past for gold mining operations. For the Bear Valley project, Yuba redesigned and furnished the conversion equipment necessary to adapt these dredges for recovery of "radioactive blacks." The first dredge, a 4½-cubic-foot unit, was refitted and ready in January 1955. It was to serve as a forerunner for the larger, redesigned 6-cubic-foot dredge which was to be completed at a later date. The latter was completed in June 1956.

Together the dredges handle about 8,000 yards of gravel per day while working around the clock. The larger boat reclaims about 5,000 yards of the valley fill, while the smaller unit digs the remainder. From the placers, the 6-foot dredge recovers 100 to 120 tons of black sand daily; the 4½-foot dredge



DREDGE TAILING is leveled in accordance with Idaho law. Leveled tailing is covered with topsoil, which is stripped in front of dredges, and then seeded.

Technical Data—Porter Bros. Corporation Bear Valley, Idaho Dredging Operation

Characteristics of Deposit

Total gravel dredged per day	7,000-8,000 cubic yards	Total black sand concentrates recovered per day 150-200 tons
Average black sand content of deposit	50 pounds per yard	Specific gravity of black sand 3.5 to 5.9
Euxenite content of deposit	0.3 to 1.5 pounds per yard	Specific gravity of gravels 2.7

Dredge Specifications

	6-cubic-foot Dredge	4 1/4-cubic-foot Dredge
Ladder length	103'-10" c. to c. suspension	62'-0" c. to c. suspension
Number of buckets	106	68
Bucketline speed	24.3 buckets per minute	28.4 buckets per minute
Size of buckets	6 cubic feet	4 1/4 cubic feet
Bucket-line drive	125 hp.	75 hp.
Type bucket-line drive	V-belt and double reduction gears	V-belt and double reduction gears
Ladder hoist	125 hp. double-drum	25 hp. single-drum
Max. ladder angle	48°	45°
Hull, no. pontoons	36	26
Size hull	127'-2 3/16" x 58'-1 1/8" x 8'-1"	90'-5 1/2" x 44'-0" x 7'-1 1/2"
Stacker length	80'-0" c. to c. pulleys	122'-0" c. to c. pulleys
Stacker belt speed, width	307.8 FPM 28" belt	345 FPM 30" belt
Trommel size	5'-10" I.D. x 29'-10"	5'-0" I.D. x 30'-6"
Trommel speed	11 RPM	9.98 RPM
Screen size	5/8" round openings	5/8" round openings
Storage tank (concentrate)	60-ton capacity	40-ton capacity
Spuds	Single (starboard rear)	Single (starboard rear)
Width cut	130 to 150 feet	65 to 100 feet
Digging depth below water	55 feet	35 feet

Digging Procedure And Operation

	6-cubic-foot Dredge	4 1/4-cubic-foot Dredge
Means of anchorage	Two 5/8" bow lines Two 5/8" stern lines D7 Cat Stern spud	Two 5/8" bow lines Two 5/8" stern lines Two old spuds Stern spud
Bucket life	Manganese steel bucket lips; approximately 9 mo. life; not rebuilt; install new lips.	Manganese steel bucket lips; approximately 9 mo. life; not rebuilt; install new lips.
Means of advance	Stern lines and spud	Stern lines and spud

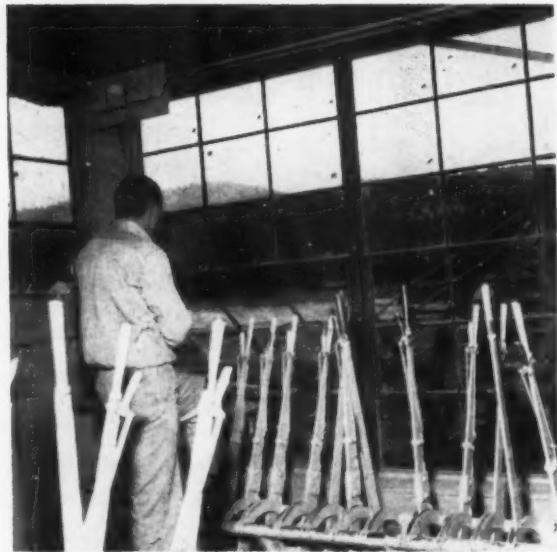
Jig Characteristics And Operation

	6-cubic-foot Dredge	4 1/4-cubic-foot Dredge
Size shot	5/8" steel shot	5/8" steel shot
Other bedding	5/8" x 5/8" magnetite	5/8" x 5/8" magnetite
Depth bed	2"	2"
Jig adjustment	Required periodic adjustment depending on black sand by jig operator.	
Jig stroke rougher	1 1/4"	1 1/4"
Jig cycles	125 per minute	125 per minute
Cleaners "A" cell	5/8" stroke 225 cycles	5/8" stroke 225 cycles
"B" cell	5/8" stroke 170 cycles	5/8" stroke 170 cycles

The above jig settings are varied dependent upon black sand content.



FLOWSCHEET ABOARD both dredges includes both rougher and cleaner jigs. The above picture shows the port side Yuba roughers on the 6-cubic-foot dredge at Bear Valley.



WINCHMAN'S VIEW of dredging. The supply of columbates to the placer was controlled by distribution of minerals in host rock and by glaciers which formed closed valleys.

produces 40 to 50 tons of black sand concentrate daily.

The large dredge was designed to dig 55 feet below the water line; the small dredge is capable of digging to 35 feet. Careful planning is required to schedule blocks of ground to be mined by each dredge in order to utilize the digging characteristics of each unit most effectively. Generally, the small dredge skirts the perimeter of the deposit, and therefore it will rarely have to dig as deep as 35 feet.

Normally a 400-foot-wide pond is carried for the larger boat which requires a 12-foot depth for flotation. Pond widths have been as great as 600 feet for the 6-foot boat, but this imposes an added load on dredge-to-shore pumping of concentrate. A 200-

foot pond width has been found to be most effective for the 4½-cubic-foot dredge. This boat incidentally requires 9 feet for flotation.

Dredge Flowsheet

The flowsheet on both dredges is essentially the same. The dredge gravel is washed in a trommel with ½-inch round openings. The oversize drops to the stacker where it is conveyed to waste. The undersize is sumped and introduced by a Vacseal pump to a distributor serving two parallel jiggling circuits, one on the starboard and one on the port side. On the six-foot boat, each circuit is equipped with eight, 2-cell, Yuba rougher jigs and two, 2-cell, Yuba

cleaner jigs. The hutch products of the rougher jigs are collected in a sump and pumped to a Dorclone for dewatering prior to cleaning. These dredges are unique in that cyclones have been placed in the circuit. The use of these units makes it possible to carefully regulate water to the cleaner jigs to compensate for the widely variable heavy mineral content of the sand lenses.

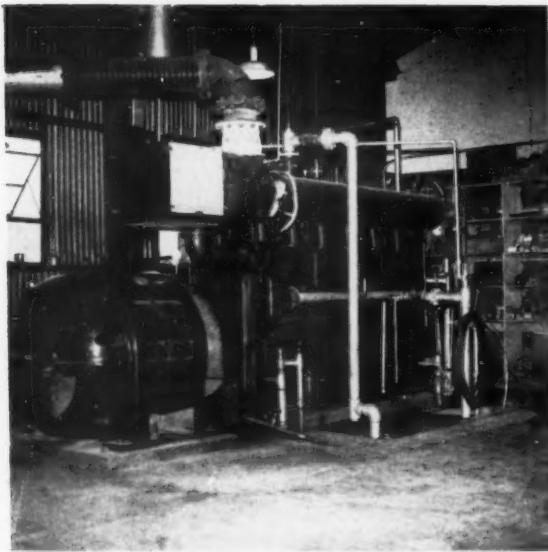
The cleaner tailing is recirculated to the distributor to be divided among the rougher jigs. The cleaner concentrate is collected in a tank and periodically pumped ashore through a rubber hose suspended from a steel cable spanning the pond. The shore-side of this span is attached to a tank mounted on four legs which, in turn, are mounted on skids. The legs provide sufficient clearance for a truck to drive under the tank to pick up the black sand concentrate periodically. Tractors move the skid-mounted tanks as excavation requires. The concentrate is trucked to a concrete slab for dewatering to a contained moisture content of approximately 8 percent.

Material flow on the smaller, 4½-cubic-foot boat is nearly identical to the above description of the larger dredge. The former, however, contains two circuits made up of 6 roughers and one, 2-cell cleaner, with cyclone dewatering between the roughing and cleaning steps.

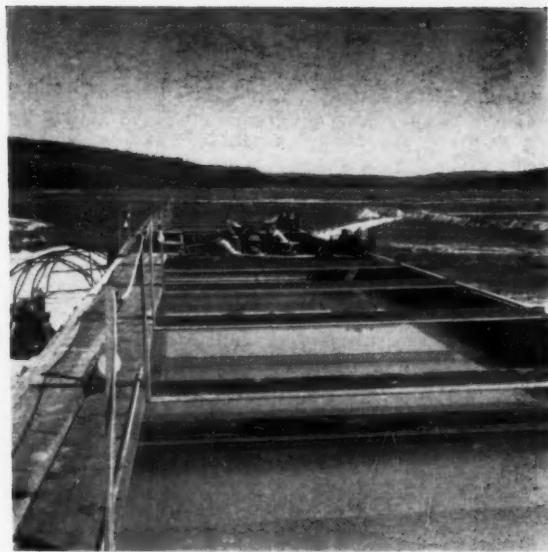
The gravels in the Bear Valley deposit present an easy digging problem. The deposit is loosely compacted, and boulders are practically non-existent. The placers are bottomed by quartz



HOW WATER TREATMENT PLANT looked after it was covered. The creek draining the valley is crystal clear below the dredging operation due to water treatment facilities and complete isolation of area being dredged by diversion canals.



POWER PLANT for dredges is centrally located at the camp. It consists of an Ingersoll Rand Turbo-charged Diesel which drives a General Electric 625 KVA generator.



SETTLING TANKS to clarify pond water are shown above. The tanks are equipped with drag type rakes. Separan 2610 and sulphuric acid are used to flocculate the solids.

monzonite which is badly shattered and decomposed. The top foot or so of the bedrock digs quite easily. The surface of the valley is covered by typical valley grassland characteristic of this altitude. The need for clearing ahead of dredging is only very slight. Occasionally a small tree is uprooted by bulldozers.

The speed of the bucket-line on each dredge is adjusted according to the tenor of the gravels being dug. This is imperative in order to avoid overloading the jigs. Periodic adjustment of jig settings are required to compensate for variable black sand content of the feed.

Dredging Laws

To preserve fish and wildlife, Idaho dredging laws are quite explicit in requirements pertaining to the use of mud settling ponds and leveling of tailing piles. Section 3 of the 1954 Idaho Dredge Mining Act states in part: That any firm conducting a dredge mining operation in Idaho is required to smooth over all ground disturbed by the operation. Such ground so disturbed is to be leveled reasonably comparable to the natural contour of the land prior to such disturbance. In addition, all water courses disturbed by dredging shall be replaced by the operator on meander lines with pool structure conducive to good fish and wildlife habitat and recreational use.

Section 4 of the above act contains the following provision: That where any person, firm or corporation conducts a dredge mining operation

where the water used in such mining process flows into a stream in the state of Idaho, it is hereby required that such operator shall construct settling ponds of sufficient capacity and character to reasonably clarify the water used in the mining process before such water is discharged into the stream.

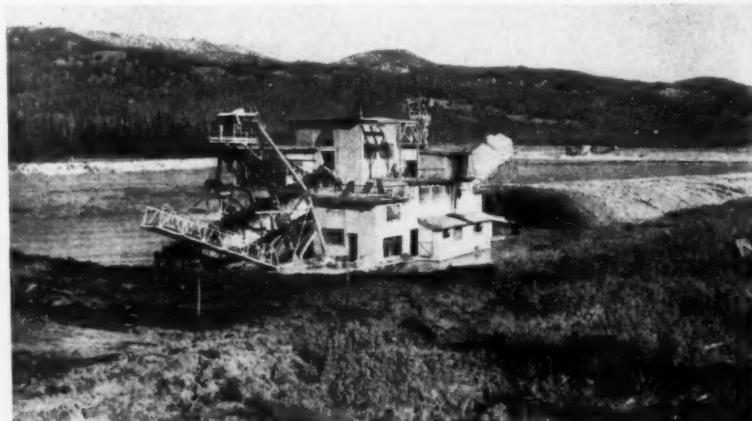
Porter Bros. Corporation has taken extensive steps to meet these requirements and to restore the land to its natural beauty. The creek, below the dredging operation, is crystal clear thanks to effective stream diversion and treatment of pond-water to settle the slimes. The immediate area being dredged is completely isolated by diversion canals on both sides of the valley. A dam across Bear Valley Creek at the upper end of the valley diverts the natural stream flow to the

temporary channels. All water from the valley drainage slopes enters the diversion canals or the stream below the area being worked.

Pond Treatment

Water from the dredge ponds (5.5 percent solids) is pumped to settling tanks for clarification using both Separan 2610 and sulphuric acid. Clean water overflowing the tanks is returned to dredge ponds, and settled slimes are discharged at 8 to 10 percent solids to a divided mud basin. Effluent from the mud basin returns to the dredge ponds. Make-up water is drawn from the creek. Consumption of Separan 2610 amounts to 8 to 12 pounds per day. Sulphuric acid con-

Continued on page 62



EXPLORATION of the placer began in 1951 and full production was reached in 1956. The above picture shows the 4½-cubic-foot dredge which was re-equipped by Yuba Manufacturing Division.

Easy Metal Availability Featured 1957

By **GEORGE O. ARGALL, JR.**
Editor

The year 1957 for the mining industry was more than one of rolling adjustment. It was a year of over production of most metals, a year of declining metal prices far ahead of the slight downturn in consumption, and a year of monumental governmental actions concerning the mining industry. In retrospect many of the predictions and expectations outlined in this annual article last year—and the last several years—have taken place. Outcome of other predictions has been slowed. Still others have been wrong. In final retrospect the year-end balance sheet definitely is on the plus side so that confidence grows in the ability to once again write a similar article.

This year, 1958, in prospect or in perspective is, of course, shaped by past events. This is the time of the rolling readjustment. It will continue, too, for the mining industry for the balance of the year. No new all-time production records will be set. There will be no great uranium or other rushes. But there will be continued orderly development of new mines, new plants, and new techniques. More and more money from more producers is being channeled into research and development. It took this current over-abundance of productive capacity to promote the need for new markets, for expanding old ones, and for taking over those held by synthetic or inferior products. Metal selling may have really started in 1958 when we look back from 10 years ahead. The foregoing is based on one premise; too much production. There's nothing wrong with the mining industry that a greater demand for metals won't cure. Greater demand will bring about a fair price too; not run-away price which in the long run is worse than a low staple price.

Readjustment means efficiency not capacity in all operations. This is the year where the engineer assumes a new role. Not how to treat more ore in a given plant, but how to treat the optimum tonnage for highest recovery at lowest cost.

In the long term view the greatest tragedy of the current situation has been the slow down in many almost wild cat exploration programs by both large and small companies. In the immediate view the closing of small mines creates a difficult reopening problem.

Metal prices just can't go too much lower. The only way will be up and while probably not this year



production will up with prices next year and the years ahead.

Engineering and technology in their expanding roles are worthy of first consideration. The Technical Achievement of the Year is a good place to start because of its import on all lead-zinc miners.

Technical Achievement of the Year was the development of blast furnace smelting of zinc-bearing charges of various compositions and grades to yield metallic zinc and lead bullion containing any precious metals in the charge. Mr. S. W. K. Morgan, research director, Imperial Smelting Corporation Ltd., Avonmouth, England is honored for directing the project from laboratory studies through a commercial furnace producing 40 tons of zinc daily. See October 1957 **MINING WORLD** for Mr. Morgan's

complete report on this new process which competent observers know will change, for the better, the zinc mining and metallurgy of certain ores.

Man of American Mining for 1957 is **P. D. Honeyman**, vice president and general manager, Inspiration Consolidated Copper Company, Inspiration, Arizona for the vision and courage to undertake the installation of the Dual Process at Inspiration. Since 1945 he has faced crisis after crisis and has had the foresight and ingenuity to overcome problems of low grade ore, high underground mining cost, changing character of ore, and difficult metallurgy. His loyal staff made this designation possible and he is the leader that made their work so effective.

Open Pit Mine of 1957 was United States Borax & Chemical's new open

Low Cost Low Output Looms For 1958



pit at Boron, California. The new pit will permit recovery of 100 percent of the ore body, will permit rapid expansion of production by 30 percent, and will permit rapid future expansion as needed. To develop the pit more than 10,000,000 tons of waste was removed to a depth of 137 feet under contract by Isbell Construction Company. United States Borax has been mining ore since May at a 4,000 ton per day rate. New and unusual drilling and blasting methods are used.

No list of important open pits could be made without including the new pit of Calera Mining Company at Cobalt, Idaho where first ore was mined during the year. This pit with a high stripping ratio is unusual because it is used to mine ore in a vein. Pitting is possible only because of a topographical freak.

Canada is the location of the **Foreign Open Pit Mine of the Year**. Gunnar Mines, Ltd. operates the pit to mine uranium ore. This is one of the northernmost pits in the world and Gunnar's engineers have perfected a number of operational tricks to keep equipment working at maximum efficiency during long periods of very low temperatures.

In 1957 the **Underground Mine of the Year** was American Gilsonite Company's Cowboy mine at Bonanza, Utah. This is a very unusual mine where the company pioneered and perfected the world's first hydraulic jet stoping method in a vertical vein. All ore mined, more than 500 tons per day, is pumped to the surface in a stream of water.

At Carlsbad, New Mexico on January 2nd an event happened which

made the Potash Company of America's mine a very strong contender for the year's honor. On that date the 500th mile of underground entry was driven in the mine whose underground workings now cover about 18 square miles. Importantly one of PCA's designed and engineered continuous miners drove that 500th mile.

Foreign Underground Mine of the Year was in South Africa where another in a long series of important large mines started gold production at the first of the year. Buffelsfontein Gold Mining Company, Ltd. wins the honor, not because it is a bigger mine or a richer mine than its neighbors, but because the mine was planned and developed so that ore would be available to operate the mill at capacity as soon as it started. This meant mining 100,000 tons of ore per month from a new mine. Not building up tonnage gradually, the mine is developed through two circular shafts, 5,187 feet deep.

United States Discoveries of the Year were made by St. Joseph Lead Company, and Bear Creek Mining Company. All indications point to the fact that St. Joe has a new "Lead Belt" in southeast Missouri. While not as large as the long famous "Lead Belt" it does have good strike length according to reports and will take as many as four shafts for mining.

Bear Creek Mining Company made two large discoveries during the year. Both apparently low grade. The first was in Beaufort and Hyde counties, North Carolina where Bear Creek optioned more than 60,000 acres of phosphate bearing lands. The phosphate beds, assaying from 8 to 31 percent P_2O_5 , are from 45 to 250 feet deep. The company announced about mid-year that it contemplated building of a multi-million dollar plant if sufficient phosphate was found. Bear Creek did extensive drilling north of Safford, Arizona during the year. Reportedly for copper with many holes finding copper according to reports of assays.

Extractive Metal Plant was the Avonmouth, England smelter of Imperial Smelting Corporation Ltd. where the successful process was developed to use a blast furnace for smelting zinc bearing charges. This plant was described in the October 1957 issue of **MINING WORLD**. Similar plants will first be built in Australia.

Cleveland-Cliffs Iron Company built and placed in operation the **Ore Preparation Plant of the Year** to serve Marquette Iron Range ores. This new plant, by several processes including

Mining Looks To 1958—And Beyond

Some things are easy to predict for the minerals industry in 1958—and beyond. It is self evident that the surplus of most metals will continue for the immediate future. Actually the supply-demand position of many is closer to balance than is generally realized. Any strong action by the federal Government in accelerating defense needs would strengthen the position of all metals.

The mining industry is caught in a worse position than most of the nation's basic industries because of foreign metal dumping as was so carefully documented at the recent United States Tariff Commission hearings in Washington, D. C. Largely in response to government demands of the Korean War, the productive capacity of the industry has been expanded beyond effective demands. To operate mines below capacity costs money. It costs money to close them down, too. Profits are squeezed lower.

It's not an all dark picture, however. Research continues and will be expanded to offset Russian technological gains. This means development of new things. This means metal to build them and metal to build them with. There's nothing wrong with the mining industry that won't be corrected by a higher demand. Capacity is too great for the immediate future and the market must be expanded up to it.

Don't be too surprised to see growing interest culminated by the eventual installation of German bucket-wheel type excavators for open-pit mining and stripping in the United States. Interest is as widespread and varied as Florida sand and California gravel.

Big things are ahead for Molybdenum—The Metal of The Year. Don't be surprised to see Climax Molybdenum Company developing and mining way below the Storke level in a few years. The answers aren't all in yet but it looks like Climax's best bet for a new mine is in central Colorado not too far from the Climax mine. The British Columbia exploration projects may prove too small or too difficult and costly to mine.

Based on past success of the geological staff, it is safe to predict that the Rio Tinto Canadian group will come up with a molybdenum mine in Canada. The other major molybdenum project is at Questa, New Mexico where Molybdenum Corporation of America is trying to develop enough tonnage for a "porphyry" type operation. A guess, not a prediction, points to adequate grade for mass mining, but with the tonnage on the low side.

American Gilsonite Company's sump-to-mill pumping of gilsonite ore has been so successful that it's safe to predict its being considered by other companies mining everything from borax to zinc.

You can watch for a real celebration and summation of metallurgists' achievements when the 50th anniversary of flotation rolls around in 1961.

The year end slow down in steel production put a damper on raw material expansion plans. This may defer, but not permanently, the proposed taconite plant in Wyoming for which cost estimates by contractors are being considered right now. Also projected is the largest mill under one roof ever considered. This will be for taconite, too, but in Minnesota.

You will see more Russian metals shipped from behind the Iron Curtain in 1958. So delicate has been the demand-supply situation at certain times during the past year that the Russian metal tipped European prices down, in fact, Russian ore reached the United States. Notably, quantities of zinc, chrome, tin, gold, and mercury broke the curtain. There's more to come, too.

Interest in bauxite beneficiation predicted last year will extend to Jamaica.

American Smelting and Refining Company which made so many discoveries during the past year has gone island hopping looking for bauxite from Kauai to the Leeward Islands. What did geologists find?

Count on more study and automatic control of mill circuits. The equipment is available to increase recovery at lower cost.

What to predict for uranium? That's a tough one for near term, easy for long term with rapidly expanding needs for uranium for power plants, ship propulsion, and yet unknown uses. The Russian atom-powered ice breaker *Lenin* may be the best thing that ever happened for the domestic uranium miner. Look for a step-up in efforts for the United States to catch up, and go ahead, which means more uranium demand.

For the near term. New Mexico ore discoveries north, northeast, west, and northwest of Ambrosia Lake can be made by any firm committing itself to drill several hundreds of holes. The ore discovery chances are far ahead of the ore finding incentives.

Don't be surprised if the Atomic Energy Commission awards a contract to permit a new mill for central Nevada, at least one additional mill for the Gas Hills, and probably two other contracts for new capacity there.

Watch for lower mining and hauling machines, both surface and underground. Designers are hard at work to lower units without sacrificing capacity. One firm reportedly has set a goal for developing equipment for high capacity hard rock loading and haulage at a height of only 30 inches. Use of electric powered loading machines will increase.

Open-pit uranium mining grows in importance. Will somebody invent a workable auger which will cheaply mine thin ore lenses in the pit walls as much as several hundred feet from face? Coal miners do it.

screening, drying, and HMS, beneficiates underground ores from several mines to make a more acceptable blast furnace feed.

Geologic Discovery of the Year, or rather the announced discovery of the year as it is usually several years after the true discovery before details are revealed, was the East Pima, Arizona project of American Smelting and Refining Company. This is an example of the delayed announcement as drilling started several years ago and to the end of the year more than 65,000,000 tons of copper ore assaying about 0.90 percent had been indicated. This is also the scene of what might be considered by many as the **Mineral Bid of the Year** for ASARCO paid the Papago Indians \$1,066,007.04 for mineral rights on three tracts totalling 15,000 acres. ASARCO wanted these tracts badly because the next highest bid was only \$357,644.98. The ore body does not crop out. Its discovery followed geologic projection of known ore bodies in the nearby Pima Mining Company and Banner Mining Company mines.

United States Mill of 1957 was at Inspiration Consolidated Copper Company, Inspiration, Arizona where 15,000 tons per day of washed acid-leach tailing is treated. Mill recovers sulphide copper from oxide-leaching-plant tailing. This is Inspiration's famous Dual Process which stretches ore reserves by recovering nearly all the copper in the mixed ores. This honor for the Inspiration mill is doubly deserved because Inspiration built this mill and in 1915 started operations using the flotation process as the major method of recovery. This was the first major mill in the United States to use flotation. This was a pioneering step in 1915 and Dual Process is a radical step in 1957. Inspiration's honor is well deserved.

The **Foreign Mill of 1957** honor goes to the new dry magnetic iron ore separation plant of Luossavaara-Kiirunavaara AB, Kiruna, Sweden which was officially dedicated on October 1st. This new Central Plant has a designed capacity of 4,600 tons per hour when the eight sections are in operation. Eight ASEA Koepe hoists mounted at the top of the mill hoist ore directly from underground through and to the top of the mill from which it flows by gravity to the magnetic separators and screens which produce five grades of iron ore plus waste rock.

New Jersey was the scene of **The Eastern Discovery of the Year**. In the Lakehurst area ilmenite bearing sands of commercial grade and large tonnage were discovered by New Jersey State Geologist's field staff. Actu-

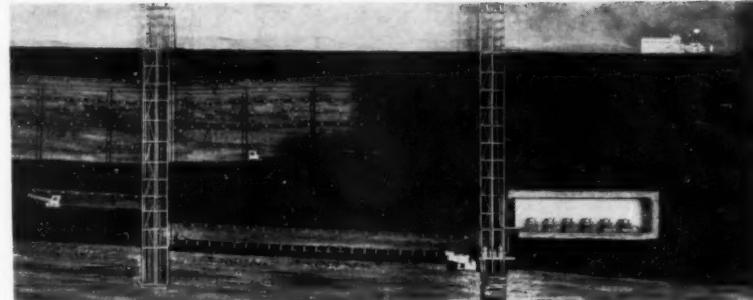
ally the discovery was the recognition of the economic possibilities of the area rather than the discovery of ilmenite. At year's end bulk sampling and metallurgical testing was underway.

Western Nuclear Corporation has been judged to be the **Small Mining Company of the Year**. It is a fully integrated, mine-to-yellow-cake-producer and built and operates the first Wyoming uranium mill. One of the reasons for selecting Western Nuclear was that it is the only United States mining company to date that sold "penny stock" and became a fully integrated producer.

The **Small Mine of the Year** is the Moonlight mine of Industrial Uranium Corporation on the Navajo Indian Reservation in Monument Valley, Utah. This mine is a tribute to the one man that made it possible—Robert G. Harding. It is an outstanding mine too when you remember that Mr. Rodgers discovered it by drilling in an area where the United States Atomic Energy Commission and the United States Geological Survey had already drilled with reported negative results. Three ore bodies within the pattern of USGS holes have been developed containing \$14,000,000 worth of ore 16 feet thick. In making the nomination for the award one of the nation's best small miners—one of the few who can really appreciate a small miner's problems had this to say, "Starting from scratch on a sandy desert in February by October of the same year the mine was up to a routine monthly production valued at over \$100,000. By carefully blending mechanization with hand labor one of the most economical mining operations on the Colorado Plateau is the Moonlight mine."

Foreign Discoveries of the Year were in Canada. Not surprising with the vast sums of money, man hours, and equipment used in that well mineralized country. The first, and it was really a rediscovery or reevaluation and appraisal of a very old discovery was the Ungava nickel belt. During the year diamond drilling definitely proved good grade nickel-copper mineralization. It will take much more work and time to further evaluate the area. It looks like tonnage is small and it will require a very very large amount of money to make the mineralization ore in that remote location. The most recent discovery was announced in June and is the Bell River-Mattagami Lake copper-zinc-gold-silver district in northwestern Quebec. The discovery was made by the Mattagami Syndicate formed by six prominent Canadian mining companies.

United States Geophysical Discovery was by Geo-Resource Corporation



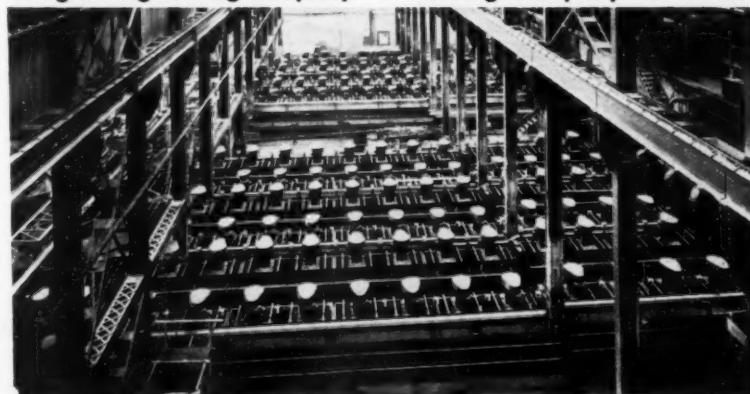
AMERICAN GILSONITE—Underground mine of year



PHILLIPS PETROLEUM—Fast-growing mining company



WESTERN NUCLEAR—Small mining company of 1957



INSPIRATION COPPER—Mill of the year 1957



PACIFIC BORAX—Open pit mine of the year



IND. URANIUM'S MOONLIGHT—small mine of year

of Spokane, Washington which found abnormally high uranium concentration by geochemical methods downhill from a barren granite-argillite contact. This was on Blue Mountain just north of Spokane Indian Reservation. Subsequently the firm obtained the first DMEA exploration loan for uranium based on geochemical prospecting. In November the firm reported finding uranium in place in schist near its DMEA exploration project.

Canada, where so many geophysical discoveries have been made by pioneering techniques was again the scene of the **Foreign Geophysical Discovery of the Year**. Yes, it was the Mattagami Syndicate's discovery outlined above. The airborne geophysical survey was done by Aeromagnetic Surveys Limited. This survey located many anomalies in an area where overburden was up to 50 feet deep. Claims were staked, ground geophysical surveys were made and diamond drilling found ore grade sulphides in a prominent anomaly.

Varian Associate's portable Varian Magnetometer has been called the **Geophysical Instrument of 1957**. This is the M-49, a 15 pound transistorized version of the original 250 pound station model. Many new uses for the instrument are being discovered. An interesting one was in Alaska where the magnetometer was lowered under water from a small boat to locate faults.

Records, Records. They are made to be broken and the mining industry came up with a lot of new ones in 1957. It's gotten to the point where its automatic in writing this article that a new shaft sinking record was set during the year in South Africa. This time it was 834 feet of 27.5 foot diameter round, vertical shaft in 30 days. It was at the No. 2 shaft of Free State Saaiplaas Gold Mining Company in the Orange Free State during September. The best day's footage was 40, and the fastest round cycle was 8 feet in 4.5 hours. A new Canadian shaft record was set in May at Milliken Lake Uranium Mines Ltd.'s production shaft when Patrick Hudson and Company sunk 406 feet.

During 25 days operations, three shifts per day, one electric 5 cubic yard Bucyrus-Erie 150 B shovel at the new Nchanga open pit at Nchanga Consolidated Copper Mines Limited in Northern Rhodesia loaded 213,296 bank cubic yards of overburden to set a new company shovel record. During the same period total stripping in the pit was also a new record of 657,620 bank cubic yards.

A new world's record for driving an 18 by 24 foot ore haulage tunnel was set by Utah Construction Com-

pany crews at the Utah Copper Division's new 5490 tunnel at Bingham Canyon, Utah. Kennecott Copper Corporation reported that in September a 170-man crew drove the tunnel 1,080 feet from the 3,607 to 4,687 foot marks. The tunnel was supported too. Some 30,000 pounds of steel ribs and 200,000 board feet of timber were used.

Fastest Growing Mining Company of the year was an oil company the same as last year and was also picked for great activity in uranium in Ambrosia Lake. This time its Phillips Petroleum Company which started with no mining staff or experience and moved fast to control multi million ton uranium reserves, establish a mining organization, and make fast headway on a 1,750 ton per day uranium mill after negotiating a United States Energy Commission contract.

Uranium Development of the Year. Could it have been anything else than the Atomic Energy Commission's decision to limit further mill construction contracts? Obviously not. And that decision will be argued for a long time. In retrospect the action was self apparent for some time.

Anniversaries, milestones, commemorations, etc. were held by many companies throughout the mining world. Here are a few that attracted attention. Minnesota's Iron Industry cooperated in observing 50 years of beneficiation on the Iron Ranges with ceremonies on August 13, 14 and 15. Today beneficiation of some type is used on more than half the ore mined on the Ranges. More than 500,000,000 tons of concentrates have been shipped since the Trout Lake concentrator of Oliver Iron Mining Division was started in 1957. Interesting too is the fact that a new concentrator employing gravity methods undreamed of 50 years ago is now being built alongside the old mill. The new will make shipping grade concentrate from tailings of the old plant too. The steel industry celebrated its Centennial on "mass production" during the year.

On February 4th, Climax Molybdenum Company mined its 100,000,000 ton of ore. Since 1918 production has increased from 200 to 34,000 tons daily to make this largest underground mine in world.

Miami Copper Company celebrated its 50th anniversary during the year. Phelps Dodge Corporation's Morenci mine celebrated 50 years of copper production; and Consolidated Coppermines Corporation its 25th year of major output.

What is now Kennecott Copper Corporation's Magna mill at Magna, Utah was 50 years old. In 1907 first ore was milled at the then 6,000 ton

per day largest "porphyry mill" in the world. This mill after several expansions has treated over 50,000 tons of ore per day.

Two important Canadian anniversaries took place. British Columbia celebrated the Centennial of the discovery of placer gold at the mouth of the Nicoamen River. Gold has and still leads to important discoveries today. The Prospectors and Developers Association celebrated 25 years of service to the great prospectors group of Canada at its annual March convention in Toronto.

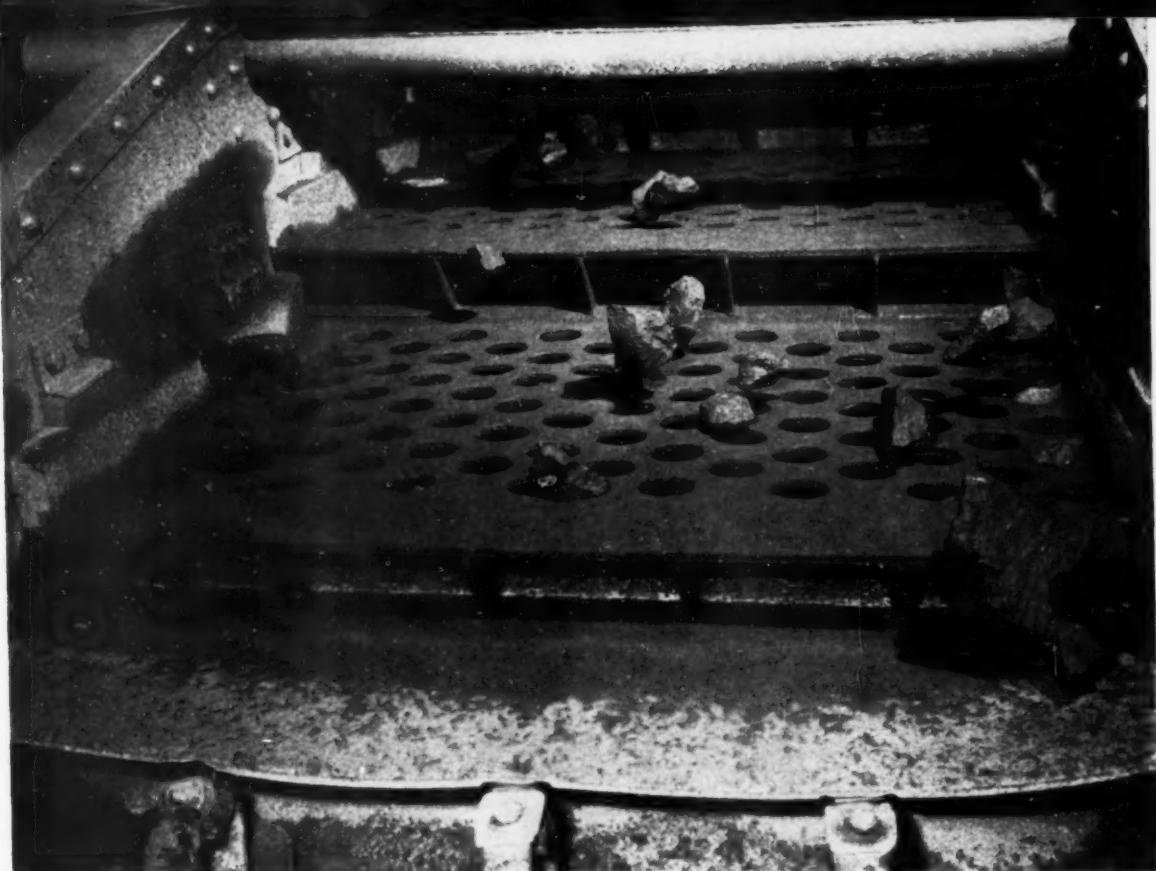
New plant dedications featured 1957 at the highest rate in recent years. All were carefully planned and carried out as good public relations in the immediate plant area and emphasized the importance of mining developments to the national economy. Ceremonies were held in the United States at Uranium Reduction Company, American Gilsonite Company, United States Borax and Chemical Corporation, Western Nuclear Company, and Metal and Thermite Company. Canadian uranium dedications were at Consolidated Dennison Mines Limited and Lake Cinch Mines. In Chile the La Africana mine was dedicated by Santiago Mining Company.

Question of The Year. Where will the first United States blast furnace for smelting zinc be installed?

Hopes For 1958. For the gold miner—a favorable ruling by the Supreme Court on World War II damage cases. For the lead-zinc industry—relief by the United States Tariff Commission. For the copper miner—Congressional action to raise the present Peril Point. For the uranium miner—speeding up of the programs to demonstrate the commercial feasibility of using more uranium for power plants, steam generation, salt water evaporation and countless other uses. For the Blind River uranium miners, already one of the world's greatest mining districts—a market for the thorium content of the ores. For the tungsten miners—the Congress of the United States keeping its sacred word and appropriating funds to permit carrying out law of the land.

In ending this review it is most fitting and truly appropriate to extend industry thanks to the scores of hard and untiring workers in the minerals industry for making it the world's greatest and most progressive industry. Special thanks to Otto Herres for his years of work on the National Lead Zinc Committee which laid a great foundation for the domestic miners in the corridors and halls of Washington. Thanks too to the companies and associations who are doing so much to expand and promote markets and uses for all metals.

THE END.



RUBBER COVERING on top of this Kiruna screen has an estimated life of 700,000 tons of ore. The $\frac{1}{2}$ -inch thick rubber layer

is both bonded and bolted to steel plate. Note the sharp jagged edges on the hard heavy magnetite ore bouncing over the screen.

Kiruna Proves It Takes a Lot of Hard Sharp Heavy Iron Ore To Wear Out Rubber Chutes

By AXEL W. KJELGAARD

Rubber, a very wear-resistant material, is used for many metallurgical applications where abrasion by fine pulps or finely crushed ore is a problem.

It has had limited application where coarse ore was being handled. Now, for the first time, the Kiruna mine in Sweden has successfully extended its use to rubber chutes and screen covering for coarse material.

In 1951 when planning started for the new iron ore concentrating plant of Luossavaara-Kiirunavaara Aktiebolag at Kiruna, Sweden, it was apparent that chute design and resistant lining were of great importance. The plant was designed to treat 12,000,000 metric tons of heavy hard ore annually with lumps up to 4 inches in size.

At Kiruna, ore is crushed underground to minus-4-inches and hoisted directly to top of the mill building and dumped into bins. Ore from bins is fed to two concentrating sections, each with three screens and four dry magnetic cobbers. Each cobbing unit comprises two permanent magnet drums. Only the minus- $\frac{1}{4}$ -inch material is treated in a wet circuit.

Previous Kiruna experience had proved that the average life of 3-inch thick manganese steel (old crusher plates) chute liners was about 150,000 tons. Screen plates with round holes passed only 25,000 to 37,000 tons. Maintenance and replace-

ment costs for screens and lining would be very high in the new plant.

Rubber was known to resist abrasion, so a rubber-lined chute was installed for testing. Ore, up to 4-inches in size, dropped 4 feet to the 45° deflection plate made of two $\frac{1}{2}$ -inch-thick layers of Linatex supported by spring-like loops made of two $\frac{1}{4}$ -inch Linatex layers. The basic thought was that the ore should be permitted to bounce freely. After 160,000 tons, deterioration started; and four days later the 1-inch, two-layer top was in rags. Inspection immediately showed why. During the rainy period, fine material filtered behind the liner and made it solid so that it lost its bounce.

At once it was apparent how to design and build chutes for the mill making maximum use of rubber. Use of rubber lining for chutes is shown in the diagrams and pictures for: vertical chute, vertical chute with divider, and chute between feeder and screen. Also shown is a chute built entirely of rubber (steel and chain for support only). Tonnage passed and estimated life of each are shown on diagram.

In addition to rubber lining, the use of foam-rubber with Shore hardness 0.25 for backing material is shown. Sponge rubber with 12 to 14 hardness was tested and found unsatisfactory. Foam rubber thickness used in backing the wearing rubber in inclined chutes varies from $\frac{1}{8}$ to 2 inches depending on height of fall and ore size.

Quality of wearing rubber is important, but to what degree is still unknown. It is apparent that the angle of inclined chutes is influenced by smoothness of surface.

Four types of rubber with Shore hardnesses of 30, 40, 55, and 65 are on trial. It appears that consideration should be

Mr. Kjelgaard, former Chief Mechanical Engineer for Luossavaara-Kiirunavaara, is now a consulting engineer with offices in Stockholm, Sweden.

made between hardness and ore size, i. e. the finer the ore the softer the rubber. However, tests are inconclusive to date.

The screens, where rubber is being so successfully employed on the decks, furnish a sized product to the magnetic separators since uniform feed is essential to efficient separation.

For screening ore WEDAG resonance type units are used. Two are double-decked, and the last single. Sized ore for concentration is minus- $\frac{1}{8}$ -inch; minus- $\frac{3}{8}$ -inch; minus- $\frac{5}{8}$ -inch; minus-2-inch; or plus-2-inch, minus-4-inch.

Rubber is applied successfully to top of screen decks by combination of bonding and bolting. Both the steel deck and

rubber surface are thoroughly cleaned with a steel brush and washed with a solution before they are joined. The adhesive binder is brushed evenly on surfaces. The rubber is additionally secured firmly in place with flat-head bolts recessed into rubber, yet passing through it in a round hole $\frac{1}{8}$ -inch smaller than the hole in the steel plate. This bonding technique has proved satisfactory with screens handling up to 400,000 tons before rebonding. The rubber decking does not creep or buckle to a point where fine ore works under it until nearly 600,000 tons have been handled.

Several adhesives have been tested with good results, but better results are expected.

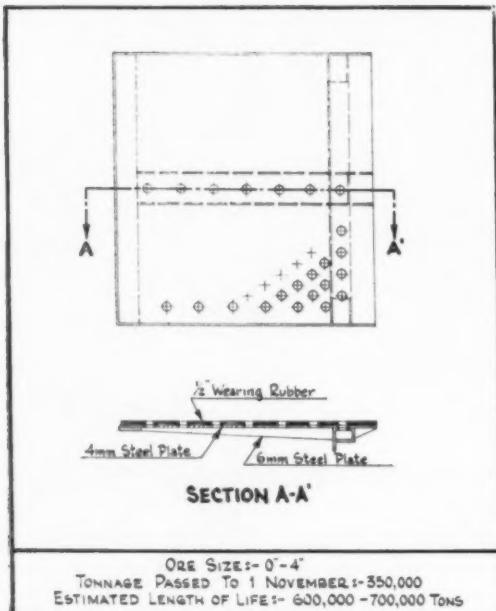
A big advantage of rubber chutes and screen decks is the lowering of noise level from 107 to 96 decibels. Also, the higher pitched tones are completely absorbed making the noise more bearable.

Rubber and steel chutes are the same price, but the longer life and shorter repair time are very much in favor of rubber.

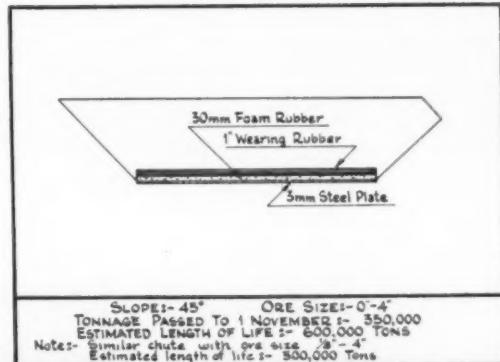
The only disadvantage is that rubber is flammable, so great care must be taken when burning and welding steel in the mill.

Investigations are still underway to solve the following questions. 1. Best design under different conditions. 2. Choice of correct rubber. 3. Can a nonflammable material be found? and 4. The relation between thickness of foam and wearing rubber under different conditions.

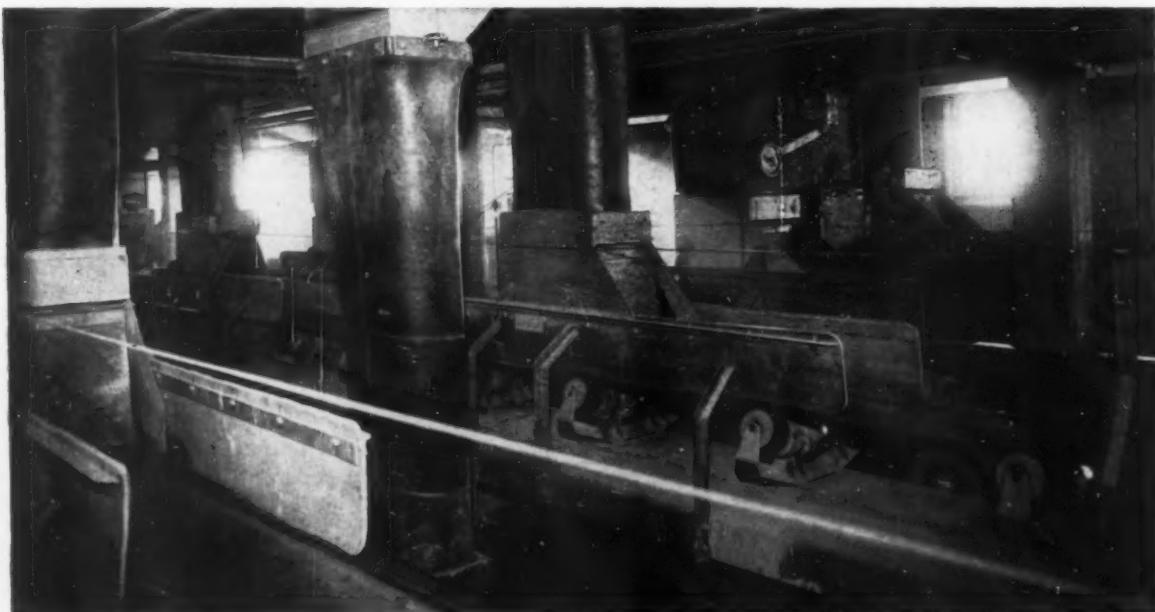
It is the author's opinion that this new technique will eventually influence the design of discharge points of many of the machines to which rubber chutes may be attached.



← Screen deck

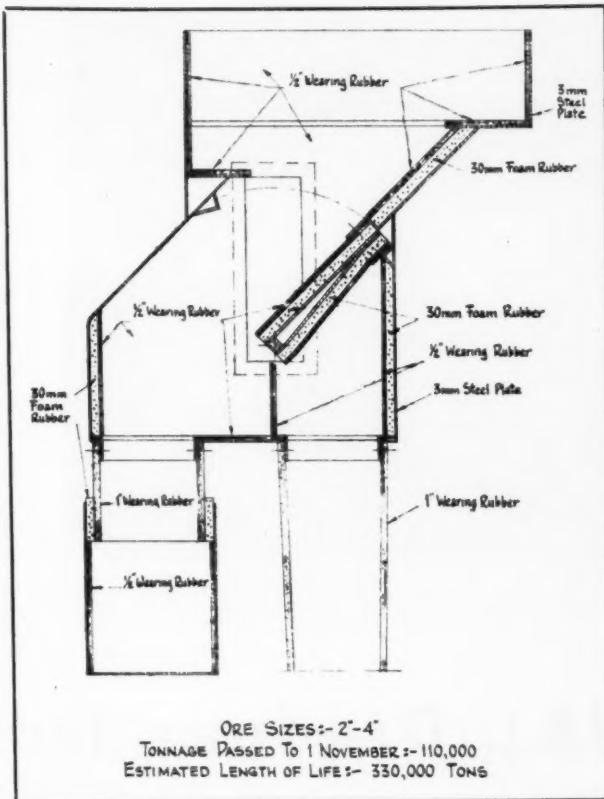
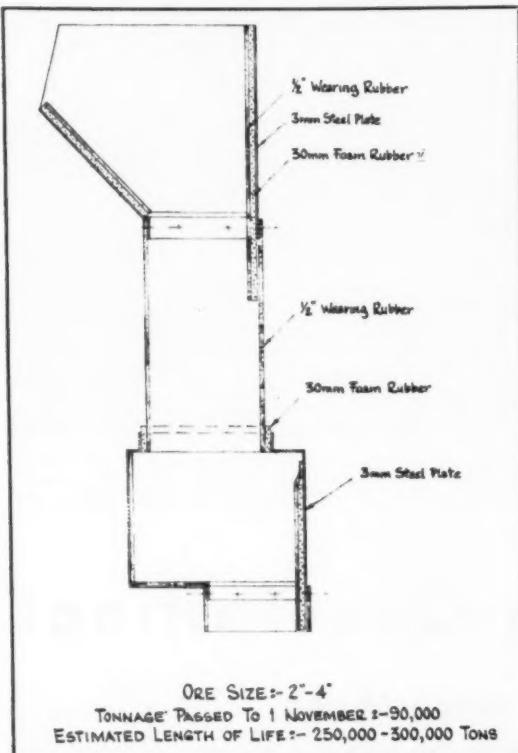


Chute between feeder and screen →

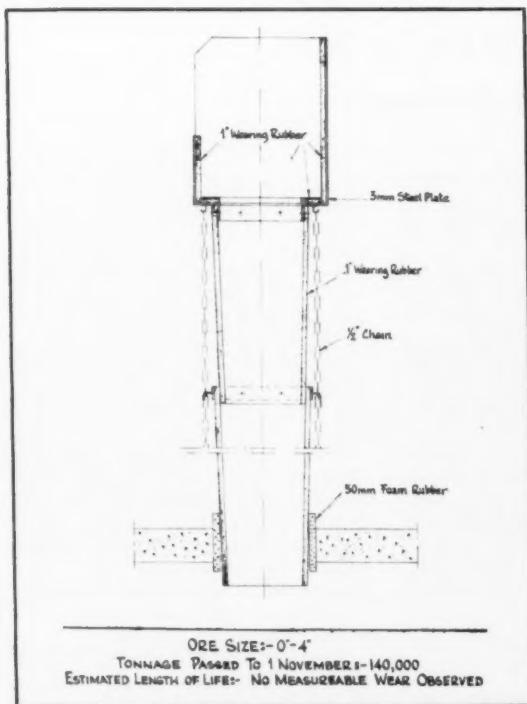


Rubber chutes to rubber belts

Vertical chute with divider



Vertical chute



Vertical chute, 30-feet long

Vertical rubber chute



DREDGING IRON on the Mesabi Range. This floating unit pumps reclaimed tailing to concentration mill on bank. Workmen add 30-foot length of Spiralweld pipe to line.



CUTTER HEAD loosens Hill-Annex tailing for this dredge which pumps it to plant at left. Monitor knocks down banks, breaks chunks, but is seldom needed in the old tailing pile.

J&L Dredges Iron-Ore Tailings

**Two-Man Crew on Dredge Mines
150 Tons of Mill Feed Per Hour
From Which Five Men in Mill
Produce 75 Tons of Concentrate**

By HOWARD L. WALDRON
Special Engineering Editor

Any visitor to Jones & Laughlin Steel Corporation's new Hill Annex Tailings Reclamation plant at Calumet, Minnesota might be surprised to see a dredge operating on the Mesabi Range. He might be amazed to learn that more than 100 tons of ore per hour is handled entirely by pumps and open flow. But unless he were an iron expert, he might fail to appreciate the most important feature of the operation: It is the world's first commercial plant to use froth flotation on soft, earthy (non-specular) hematite.

The great significance of froth flotation to iron ore is just this: Applied to copper, lead, zinc, and a great many other ores which require fine grinding, flotation has proved the best method of making a high-grade product at low cost. It may well do the same for earthy hematite. If it proves to be the best method, and if its costs are low enough, flotation may then be

used to treat the many billions of tons of low-grade non-magnetic rock in the western and central portions of the Mesabi.

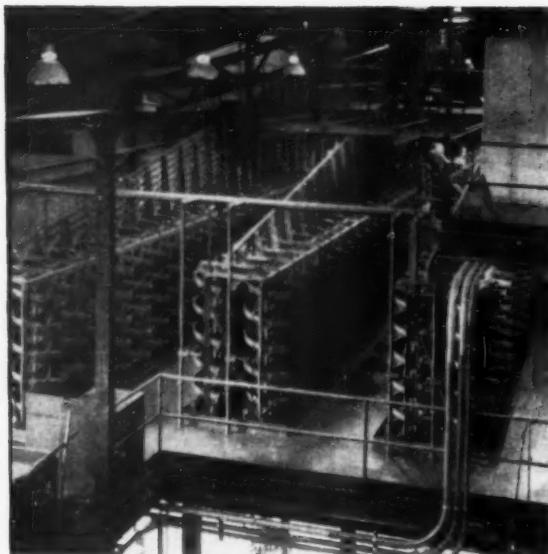
Flotation has recently and successfully been applied to the specular hematites of Michigan. (See MINING WORLD, March 1957, *Marquette's New Republic Mill Makes Iron Flotation Look Easy*.) Regarding the Minnesota ores, most of the current knowledge concerning their flotation characteristics has been known for years. This new plant assumes its great significance because it is processing large tonnages of feed and producing large tonnages of high-grade concentrates (10 to 12 tons of concentrate hourly is the currently anticipated rate of production).

Plant Will Grow

The ore body and mining plan are ideal for use of a new process. The dredge is now digging in a mineral

deposit which because of the normal segregation of tailing in a pond is coarse ore (mainly in the plus-150-mesh range). That means that most of today's concentrate is produced by the battery of Humphreys spirals. The flotation section now consists of only 10 43- by 43-inch Denver Equipment Company "Sub-A" cells which will produce 10 to 12 tons of concentrate per hour. Slowly, as the dredge digs into the finer ore zones further from the old tailing discharge pipe, the flotation section will be expanded. Finally, the flotation section will process nearly all the dredge output; very little will be extracted by the spirals. That means that J&L's metallurgists will be able to tune their flotation section to its peak efficiency before it assumes its full load.

Now let's look at the background of today's Hill-Annex mine Tailings Reclamation plant. Fee to the mine is owned by Great Northern Iron Ore Properties. In 1917, Interstate Iron



HUMPHREYS SPIRALS, 128 primary and 80 secondary, recover the plus-150-mesh iron. Feed to spirals flows from upper floor through hoses and inclined pipes. Note clean installation.



DENVER EQUIPMENT flotation cells recover the iron in the minus-150-mesh fraction of mill feed. This is the world's first commercial application of flotation to earthy hematite.

For New Spiral-Flotation Plant

Company, a wholly owned subsidiary of Jones & Laughlin Steel Corporation, began working the Hill Annex under a lease from Arthur Iron Mining Company. Interstate Iron treated the ore by conventional washing methods, which during those early days left an important part of the iron in the tailing. During those 33 years, the company mined and treated approximately 50,000,000 tons of crude wash ore and produced roughly 32,000,000 tons of merchantable concentrate. The tailing from the old Hill Annex wash plant was impounded on five flat-lying 40-acre tracts. As the pound filled, coarse rich material settled near the discharge pipe and fine, light material was carried further out. About 6,000,000 tons of that tailing can now be considered treatable under present conditions. More tonnage will be available if the price of iron ore rises or the cost of production is lowered. The treatable tailing varies from 54 percent iron (near the old discharge) to a cutoff of 18 percent or less, (about 2,000 feet from the old discharge): they average 30 to 35 percent iron, dry basis.

Laboratory Flotation

In 1950 J&L began the studies which ended in today's plant. The potential ore body (the tailing pond) obviously called for a method of re-

covering iron ore in the minus-150-mesh range. Available for that were several methods of flotation which included American Cyanamid's acid circuit, fatty-acid flotation with several variables, and amine flotation. Comparative testing of these methods on drill-hole samples led J&L's engineers to choose the American Cyanamid Company's circuit. Earl C. Herkenhoff, then field engineer for Cyanamid, did the initial flotation research on the J&L ores. His preliminary work led to testing by J&L at its laboratory in Negaunee, Michigan, and further extensive laboratory work at the Hill Annex mine followed.

Semicontinuous Piloting

Finally, three men, all of whom are still in J&L's Minnesota Ore Division, developed the flowsheet. Richard Livingston, chief ore dressing engineer, headed the pilot group; J. P. "Jim" Snider and Virgil Gustafson, ore dressing engineers, worked with him. In Livingston's words, "We worked by semicontinuous testing. We'd take a

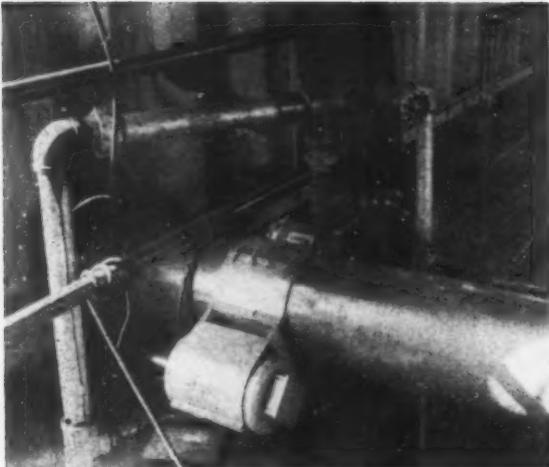
section of the proposed flowsheet, run it in a continuous manner and collect all products. Then we'd test the products in a continuous manner in a pilot of the succeeding section, and so on." This meant for instance that two spirals were set up at Calumet, one rougher and one cleaner. Approximately one ton per hour went through the spirals. Then the piloters classified and reground the spiral tailing, tested it by flotation. The result was a metallurgical flowsheet from which Western-Knapp Engineering Company's Hibbing, Minnesota designers formulated their general and detailed mill designs.

Dig That Pond

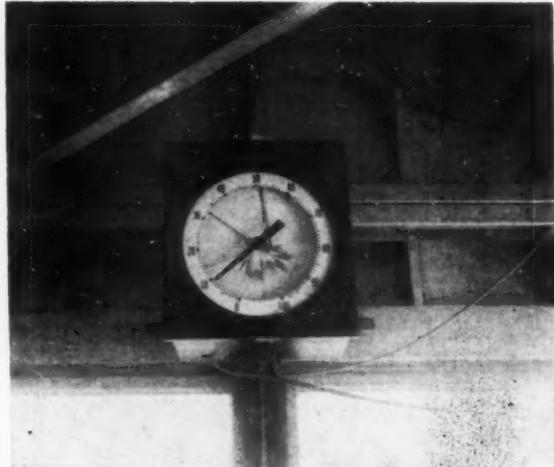
The ore body had been proven and sampled. How to mine it? A five-man management team from the Minnesota Ore Division took up the problem: Clarence Sleeman, assistant manager; W. F. Gaspar, resident engineer; C. H. Grant, chief mining engineer; D. W. Cargo, plant maintenance engineer; and Richard Livingston, chief ore dressing engineer. This team considered eight possible mining methods:

- Tractor-drawn scraper. This was given a try and found ineffective because a tractor got no traction in the loose sand.
- A dredge.

Read in February MINING WORLD how J&L engineers sampled the Till Annex tailing pond and calculated the tonnage, grade, and metallurgical characteristics of five distinct zones.



PULP DENSITY DETECTOR on dredge's discharge line picks up Gamma rays that pass through pulp. Greater the density, the higher the resistance to Gamma ray passage.



PULP DENSITY, as a percent, is recorded automatically on this dial directly above the dredge operator. By watching the dial, he can regulate digging rate for uniform output.

- A dragline, traveling screen, and pumping plant similar to those used in the Florida phosphate operations and other Mesabi tailing recovery operations.
- And five methods that received only preliminary consideration.

A hydraulic dredge seemed to have many advantages: It would produce a more constant grade than other methods because its cut would be from top to foot of bank even in ore 50-feet thick; in other words ore would slough from the entire bank slope to the intake of the dredge at the foot of the bank. The dredge would

likely have the lowest mining cost. And it would allow for simple and cheap transport of ore to the plant. How to prove it workable?

The management team studied all available literature on dredging and noted several similar jobs being done successfully. They then talked to dredge manufacturers, and finally visited operating dredges.

A visit to Quincy Mining Company's dredge at Torch Lake, Michigan was the clincher in the choice of a dredge. Quincy's dredge was operating in sand tailing from a native copper stamp mill: Quincy's sands

were much coarser than J&L's and thus were not so likely to hold the necessary dredge pond; but they did. Quincy's dredge was digging to 80-foot depth: J&L's would need to operate to less than 55 feet. American Hoist & Derrick Company submitted estimates, guaranteed that the dredge would operate effectively in J&L's tailing pond, and the management team chose the dredge.

With mine and mill estimates complete, J&L appropriated \$1,410,000 for the project. Total expenditures of \$1,250,000 to date have included approximately \$250,000 for the dredge and \$1,000,000 for the mill.

The new mill began operation in May 1957. In brief, it consists of two concentrating devices with auxiliary equipment. Humphreys spirals concentrate the coarse (plus-150-mesh) ore. Spiral tailing goes to flotation which concentrates the fine (minus-150-mesh, plus-15-micron) ore. There are also three vitally important auxiliary operations: scrubbing, desliming, and conditioning.

Calibrated Gamma Counter

Now let's look at new and important features of the operation. Control of pulp density starts at the dredge, and the key to control is a system engineered by Ramsey Engineering Company, featuring a gauge manufactured by the Ohmart Corporation. This gauge is attached to the discharge pipe (on the plant side) of the dredge pump, and it works like this: A radiation source on one side of the 10-inch pipe sends gamma rays through the pipe and pulp. A gamma ray detector (counter) on the other side of the pipe is attached, through an amplifier, to a large recording dial



WESTERN MACHINERY scrubbers abrade pulp and free slimes. Fatty acid flotation used to recover iron necessitates complete elimination of slimes to prevent high reagent cost. Scrubbers also give clean surface for reagents to work on.

directly in front of and above the operator. This recording dial was calibrated in terms of pulp density as a percent.

When a dredge is digging in, if pulp density wavers below 20 percent the operator lowers his cutter into the bank so it cuts a higher percentage of solids. If it goes above 20 percent, he raises his cutter, thus allowing it to take in more water.

Slowly Changing Feed

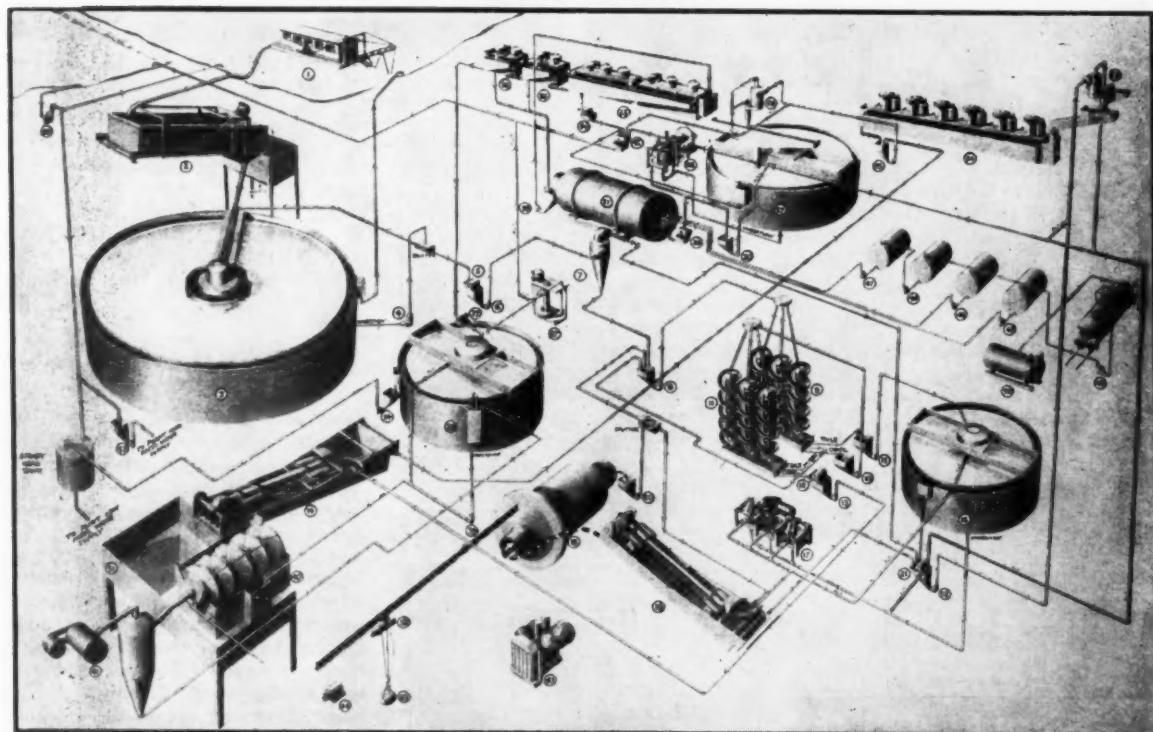
The dredge has two rear spuds. It can move ahead by alternately raising

and lowering them, or it can swing and cut arcs with either spud down. The dredge also works in a pattern of major arcs whose center is an elbow point back along the dredge's discharge line. This pattern keeps it digging in the same grade and size of material during each major arc. So the dredge will slowly work from coarse to fine and rich to lean as it progresses outward in the old tailing pond.

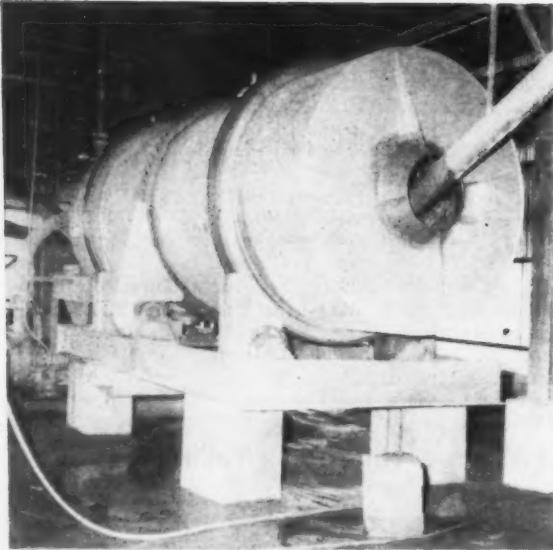
The entire discharge line floats freely and each 30-foot length is coupled at both ends by a rubber dredge coupling.

The dredge line discharges into a double-deck screen on the south end of the plant. Plus-10-mesh material (oversize) consists mainly of wood and trash; it drops into a waiting Dumptor and a workman hauls away the load periodically. Minus-10-mesh material (undersize) is thickened and passes then to a 24-inch Dorrclone which makes a split at 150-mesh. The coarse product goes to a roughing circuit of 128 five-turn Humphreys spirals. These are followed by 80 five-turn cleaners. The spiral circuit is conventional, but the installation is kept exceptionally clean by, in effect,

Flowsheet Jones & Laughlin Steel Corporation's Hill-Annex Tailing Plant, Calumet, Minnesota



1. Dredge, 10 inch, American Steel.
2. Double deck screen, 6 by 14 feet, Hewitt-Robins.
3. Thickener, 70 by 16 feet, Hardinge.
4. Sand pump, 8 by 6 inch, Allis-Chalmers.
5. Pulp sampler, Denver Equipment.
6. Sand pump, 10 by 8 inch, Allis-Chalmers.
7. Dorrclone, 24 inch, Dorr-Oliver.
8. Sand pump, 10 by 8 inch, Allis-Chalmers.
9. 128 Primary spirals, 5-turn, Humphreys.
10. Sand pump, 8 by 6 inch, Allis-Chalmers.
11. 80 Secondary spirals, 5-turn, Humphreys.
12. Pulp sampler, Denver Equipment.
13. Sand pump, 8 by 6 inches, Allis-Chalmers.
14. Rake classifier, 6 by 26 feet, Dorr-Oliver.
15. Sand pump, 8 by 6 inch, Allis-Chalmers.
16. Hydroseparators, 24 foot Diameter, Hardinge.
17. Triplex diaphragm pump, 6 inch, Denver Equipment.
18. Rake classifier, 4 by 34 foot, Dorr-Oliver.
19. Ball mill, 8 by 9 foot, Hardinge.
20. Sand pump, 2", Western Machinery.
21. Pulp sampler, Denver Equipment.
22. Sand pump, 10 by 8 inch, Allis-Chalmers.
23. Nine Cyclones, Equipment Engineering.
24. Eight Scrubbers, 66 by 68 inch, Western Machinery.
25. Sand pump, 8 by 6 inch, Allis-Chalmers.
26. Eight Cyclones, Equipment Engineering.
27. Thickener, 30 foot, diameter, Dorr-Oliver.
28. Duplex diaphragm pump, 6 inch, Denver Equipment.
29. Pulp sampler, Denver Equipment.
30. Sand pump, 2 inch, Western Machinery.
31. Drum conditioner, 6 by 16 foot, Western Machinery.
32. Sand pump (acid proof), 5 by 5 inch, Allis-Chalmers.
33. 2 3-cell flotation machines, 43 by 43 inch, Denver Equipment.
34. Pulp sampler, Denver Equipment.
35. 2-cell flotation machine, 43 by 43 inch, Denver Equipment.
36. 2-cell flotation machine, 43 by 43 inch, Denver Equipment.
37. Pulp sampler, Denver Equipment.
38. Thickener, 30" diameter, Western Machinery.
39. Sand pump, 4" x 3", Allis-Chalmers.
40. 7-Disc filter, 6" diameter, Eimco.
41. Vacuum pump, Nash.
42. Pulp sampler, Denver Equipment.
43. Air compressor, 350 cubic feet per minute, Sullivan.
44. Car puller, Joy.
45. 46, 47. Reagent pump, Lapp Insulator.
48. Proportioning pump, Viking Pump.
49. Tank car unloading pump, 2 x 1½ inch, Allis-Chalmers.
50. Plant supply pump, 14 by 12 inch, Allis-Chalmers.
51. Concrete railroad loading bin.
52. 20 HP boiler unit.
53. Suction water pump, 4 by 3 inch, Allis-Chalmers.
54. Solids handling pump, 5 by 4 inch, Allis-Chalmers.
55. Electro magnet, 39 inch, Dings.
56. Electric hoist, 1½ ton, Yale & Towne.
57. Vertical pump, 3 by 3 inch, Allis-Chalmers.



DRUM CONDITIONER, 6 by 16 feet, is used to condition flotation feed. Three reagents—sulphuric acid, fuel oil, and petroleum sulphonate are fed to this unit to insure time and contact with feed pulp.

placing the spirals in a sunken box which drains to the main sump during overflows. The arrangement of feed hoses and feed pipes is compact and neat.

No Conveyor Belts

Spiral concentrate is pumped to a Dorr-Oliver rake classifier which discharges dewatered concentrate into a bin that straddles the railroad track. A car loader discharges contents of the bin by gravity into a waiting railroad car. The concentrate arrives in the car at about 61 percent iron, dry weight, but contains about 20 percent mois-

ture; it drains in the car to about 8 to 9 percent moisture.

Note that the flow of material from dredge to railway car has been either by pump or gravity without a single belt conveyor or bucket elevator. The fact that this is an all-pump mineral plant is due largely to the dredge, but it would be impossible without the unusual arrangement of concentrate thickening and filtering. The result of all-pump transport is an exceptionally clean and quiet plant. It is, however, as general plant foreman Glenn Sarff points out, somewhat difficult to break in: Pumps must be in close balance; any pump break-

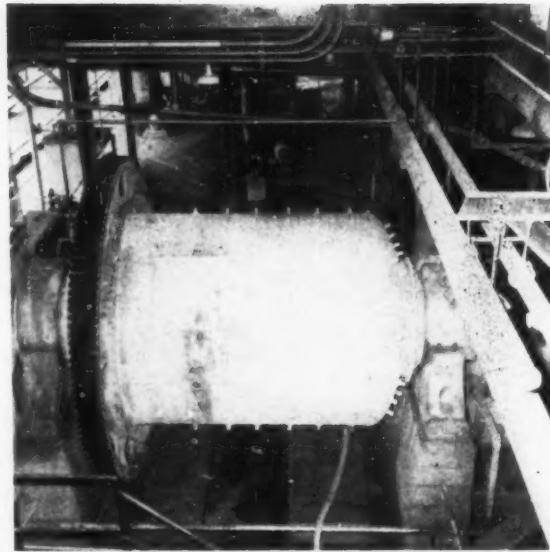
down creates an imbalance; so the best operating procedure is to develop preventive pump maintenance by schedules. Until the schedule has been established (through a knowledge of pump wear), the balance is hard to maintain.

Metallurgical Flexibility

Leaving the spirals, rougher tailing flows to a 24-foot Hardinge Hydroseparators which in turn discharges its underflow to a closed grinding circuit. An interesting part of this arrangement concerns a first splitter which can allow part of the Hydroseparator underflow to go directly to flotation without regrind, and a second splitter which can allow part of the coarse material to make a single pass through the ball mill and then return to the spirals. The first splitter is to bypass the grinding circuit. The effect of the second is just the opposite. The result is a flexibility much needed in a new plant such as this.

A bank of nine Krebs two-stage (size D10B) cyclones splits flotation feed into two products which overlap in size between 5 and 20 microns. The underflow at plus-5-microns passes to a battery of eight WEMCO 100-cubic-foot scrubbers. The function of each scrubber is to abrade or wear the inactive surfaces from these relatively fine mineral particles. The newly exposed surface is much easier to condition. Abrasion takes place mainly by a particle-against-particle wear.

From the scrubbers, ore goes to a second battery of eight Krebs



HARDINGE, 8- by 9-foot ball mill, installed on the lower floor, is used to grind oversize. Mill circuit is flexible so that the grinding circuit can be bypassed, or all or part of coarse material reground for spiral or flotation feed.



GLEN SARFF
General Foreman



R. W. LIVINGSTON
Chief Ore Dressing Engineer



JAMES P. SNIDER
Plant Metallurgist

EE10B-4B cyclones, then to a 30-foot Dorr-Oliver thickener which ups solids content from 50 to 70 percent.

Single-Point Reagent Feed

All reagents are added to the thickened pulp on its way to the drum conditioner as follows:

Reagent	Pounds Per Long Ton of Feed
Petroleum Sulphonate, American Cyanamid, No. 899	3.0
Sulphuric Acid, Concentrated	2.0
Fuel Oil, 20° Baume, 0.94 Specific Gravity	3.0

Reagents arrive at the plant in tank cars, and are stored in 17,000-gallon tanks. Petroleum sulphonate in the car is heated by steam, diluted, and stored in two tanks. Sulphuric acid and fuel oil each require one tank. Ordinary steel tanks and pipes are not attacked by the concentrated sulphuric acid (some corrosion is, however, encountered after dilution, which takes place just ahead of conditioning).

Reagent feed is controlled at a station near the diaphragm pump which sends pulp to the drum conditioner. A General Electric Company's specialty control allows for a complete range of manual adjustments of fuel oil and sulphonate. Sulphuric acid feed is manually controlled now, but provision has been made for possible later automatic pH control.

Main Loss In Slimes

The drum conditioner provides nine minutes of retention before the pulp at 30 percent solids (diluted by recirculating cleaner and secondary cleaner tailing) arrives at rougher flotation.

Primary flotation in two three-cell 43- by 43-inch Denver flotation machines produces a fine-sand tailing that joins the slime tailing in a new pond. This pond, like the old one, is on land owned by Great Northern Iron Ore Properties. The part of this tailing contributed by flotation will likely remain tailing since it will average substantially less than 2.0 percent iron. The overall tailing, which consists of the flotation tailing (2.0 percent iron) and the slime tailing (28 percent iron) will average between 6 and 15 percent iron.

Tailing from two primary cleaners and two secondary cleaners are returned to the six rougher cells. The final concentrate from flotation passes via a 30-foot thickener to a 6-foot diameter Eimco filter; it, like the rake classifier used on coarse concentrate, is in the small filter house astride the railroad tracks. Workmen seal the bot-

toms of hopper bottom cars with straw before the cars are filled, that prevents loss of the fine flotation concentrate by leakage.

The reclamation plant product will vary during the life of the mine, but it will average nearly 75 tons per hour. Grade: 56 percent iron, natural basis.

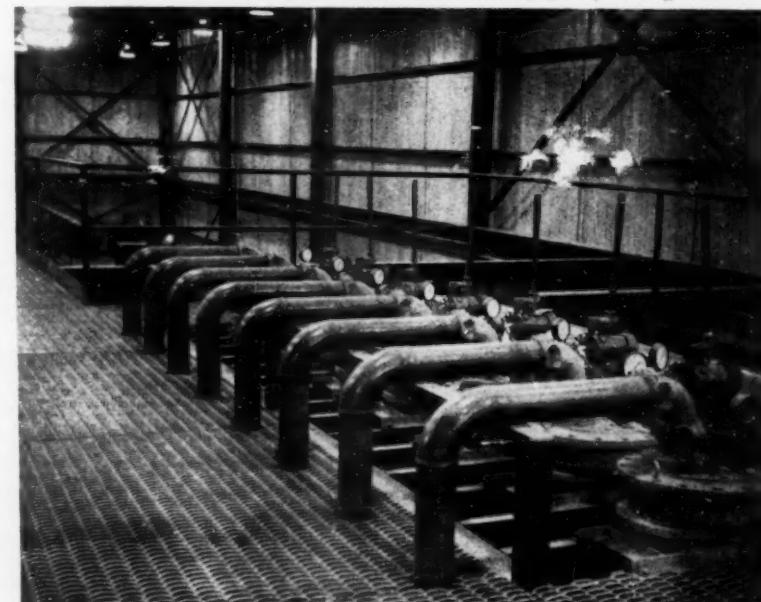
The product goes by rail and boat to Pittsburgh and Cleveland districts where it is sintered prior to charging to blast furnaces.

That, briefly, is the new Hill Annex tailings reclamation plant. It is a plant that is new in many respects. Proof of its effectiveness will come from long-run performance. Its great importance to the mining world is as a testing and proving ground for flotation of earthy hematite. That importance can be judged by Mr. Livingston's statement: "When this plant proves up, J&L will almost certainly go ahead with more flotation."

THE END



FLOTATION CONCENTRATE is thickened in this 30-foot Wemco unit ahead of filtering and subsequent loading into railroad cars. Thickener underflow is pumped to Eimco filter elevated above railroad tracks for easy gravity-loading.

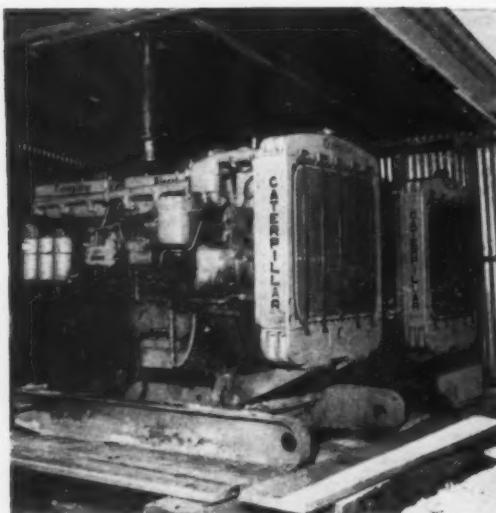


KREBS CYCLONES deslime pulp leaving scrubbers to remove all liberated slimes which are discarded to tailing. Cyclone underflow is thickened and sent to flotation. Iron in slimes can't be recovered economically.



RIO DE ORO Uranium Mines Inc.'s general superintendent, Ray Schultz, says that the high production rate at Ambrosia Lake's first uranium mine is due to the "good ground, good shaft, good hoist, and adequate development to maintain ore grade in shipments despite the wide variations in the mining headings."

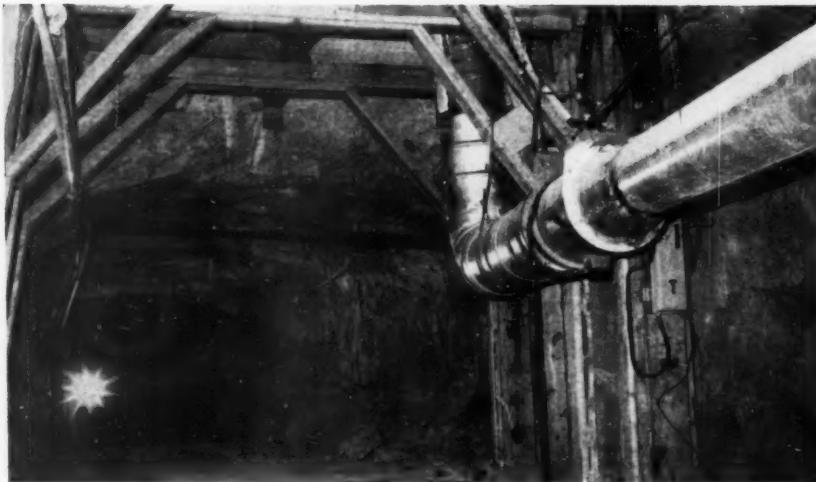
Rio de Oro – First Ambrosia Lake Mine Reaches 600 Tons Per Day



CATERPILLAR DIESEL'S generate electric power to operate the Vulcan Denver hoist and for machine shop and camp uses.

Rio de Oro Uranium Mines, Inc., first company to mine Ambrosia Lake uranium in New Mexico, is still the largest Ambrosia producer after 19 months of operation. With a production record of 120,000 tons of ore and a daily mine output of 600 tons, Rio is still the "show place" mine. And it will continue to be the leader for another six months until the real uranium giants of Homestake-Sapin Partners, Kermac Nuclear Fuels Corporation, and Phillips Petroleum Company reach production. Rio's underground operations are completely Dieselized using off-track open stope mining with pillars. Three separate ore horizons are being mined with access ramps interconnecting the levels. Off-track mining proves flexibility necessary to recover the pitching, pinching, swelling, undulating ore bodies. Many times the bottom must be taken up to level main haulage roads. High mining rate and close grade control means many faces. Rio currently has more than 80 in the mine. Of great significance to other Ambrosia producers has been Rio's experience in mining more and higher grade ore than drilling indicated.

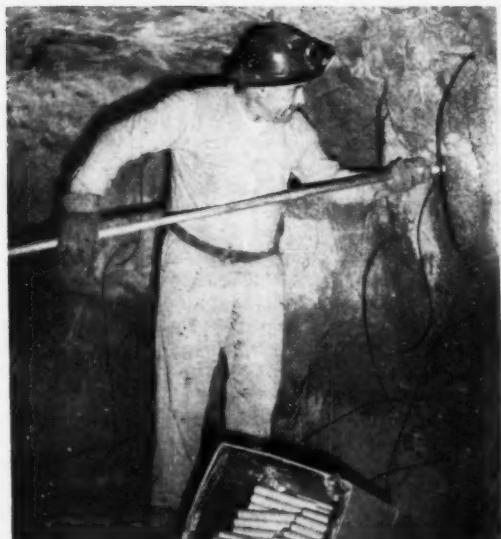
RIO MINES 600 tons per day, five days per week. Production is at the rate of 19.5 tons per underground shift. Ten machine men break the ore. Four loader operators and four drivers transport it to skip pockets. Two TD 8 International tractors with 1-cubic-yard Drott buckets load ore into one Getman CD 4 8-ton Scotecrete truck, and two Ford F6 rebuilt trucks with Hercules Diesel engines. Average haul distance is 700 feet, but will increase rapidly as the East ore body is developed. Serious consideration is being given to installation of a conveyor belt to transport ore to shaft from this long narrow East ore body.



ADEQUATE VENTILATION is the key to Dieselized off-track mining at the Dysart No. 1 mine of Rio De Oro. This Joy fan delivers 70,000 cubic feet per minute to working headings through 20- and 24-inch galvanized vent pipes. Compressed air lines in main haulage drifts are 4-inch Reynolds aluminum with light weight Victaulic couplings. Aluminum is not used close to face because it is easily damaged by blasting. All Diesel engines are equipped with exhaust gas conditioners as an aid to ventilation. Twin headings with crosscuts at regular intervals are used to circulate air to long development drifts.



SIXTY TONS per drill shift is present Rio breaking rate. Two-man drill crews drill out three 32-hole V cut rounds 6-feet deep per shift.



POWDER CONSUMPTION is 1.5 pounds per ton. Atlas and Hercules 1 and 1 1/4 inch sticks of 25 and 40 percent are used. Slower has advantages.



CONGRATULATIONS TO NEW PRESIDENT E. K. Barnes (right) from retiring president Karl W. Jasper. Mr. Barnes is Chairman of the Board, First National Bank of Spokane, and a long-time mining leader.



OPEN PITTING is the way to mine it, reports John Isbell, Isbell Construction Company, to John R. Welch, U. S. Bureau of Mines (center). Luther M. Krupp, Isbell Construction, is at right.



CAMERA CATCHES Ed Schwartz and M. H. McMillen, Mine Safety Appliances, talking to L. M. Kinney and Loren Billings of Pend Oreille Mines & Metals Company.



OLD FRIENDS get together for Northwest Convention. From left are: W. R. Green, Mines Management, Inc.; R. O. Oscarson, Bureau of Land Management; and Evan Oscarson, consultant.

What the Miners Talked Of and Heard at the Northwest Mining Convention

There was standing room only when Charles E. Schwab, chairman of the Emergency Lead-Zinc Committee, reported to delegates at the 63rd annual Northwest Mining Convention at Spokane, Washington, on the status of the lead-zinc situation. It wasn't hard to determine where the interests of the majority of those in attendance lay. Though the work of the Emergency Lead-Zinc Committee has been well publicized, those present wanted to hear the details of the recent November hearings before the Tariff Commission right from the man who was

there. Many were disappointed when Mr. Schwab said that "I can't give you any indication when the recommendations of the Tariff Commission will be forthcoming on lead and zinc." Senator Warren Magnuson later said that the Tariff Commission is waiting for several field reports before the hearing records will be terminated. From information available to the Senator, he declared that he doubted if the findings of the Tariff Commission will be ready before the next session of congress gets underway in January. They should be ready well before the

Reciprocal Trade Act extension comes up for discussion.

Though it was obvious that interest in lead-zinc was high, many regard it as a trial balloon for the entire mining industry. Several observers felt that the convention this year was one of the best balanced and most informative meetings held in some time. Retiring president of the Northwest Mining Association, Karl Jasper, opened the convention December 6. His duties will be taken over by president-elect E. K. Barnes, chm. of the board of the First National Bank of Spokane.

This year the convention featured not only the usual Canadian session, but also a session on Alaskan mining. Technical papers were presented in all fields, including uranium metallurgy, lead-zinc milling, sand filling, dredging central Idaho euxenite-bearing placers, and blast furnace treatment of zinc. Thor E. Kiilsgaard gave a fine geologic appraisal of DMEA exploration in eastern United States with particular emphasis on the Southeast.

Russia Maps Better

Thomas B. Nolan, director of the United States Geological Survey, opened a few eyes when he contrasted Russia's gigantic research program for minerals exploration with our own efforts here in the United States. He called our present geologic and exploration research small in comparison with those of the U.S.S.R. According to Mr. Nolan, only a few score geologists and chemists are engaged in geochemical research in our country. In Russia, three institutes have been established with well equipped laboratories for promoting research dealing with geochemical exploration. "It is a matter of national concern that the mineral economy of the United States has changed in the past quarter century from one of comfortable surpluses of most of the basic mineral commodities, to one in which we are importing increasing amounts of raw material supplies from foreign sources," said Mr. Nolan. "The declining rate of discovery (in the United States) has been apparent for some time . . . the Russians have mapped their entire country at a 1-to-1,000,000 scale followed by 1-to-200,000 scale mapping now said to be 30 to 40 percent complete; third stage Soviet mapping at 1-to-50,000 is 4 to 5 percent complete," continued Mr. Nolan. "It would seem to me that a country (the United States) that has been exploiting its minerals resources for over a century needs more and not less research in mineral exploration than one that is just starting to skim the cream of its mineral potential."

What About Tariff?

With regard to the lead-zinc question, Mr. Schwab summed up the situation by saying that hearings have been held before the House Ways and Means Committee and the Senate Finance Committee. And we now have live bills at both these sources. At the recent hearings before the Tariff Commission, the Emergency Lead-Zinc Committee, which represents firms controlling over 90 percent of our production, based its case for relief on two requirements—maximum increase in tariff on both lead and zinc and the

establishment of import quotas. The Committee felt that import quotas should be extended to include not only metal in ores, concentrates, and pig or slab, but also to manufactured items or semi-finished products containing lead and zinc. The Tariff Commission, however, rejected Committee arguments favoring import quotas for manufactured items and heard only testimony relating to quotas for lead and zinc contained in unmanufactured products. Mr. Schwab stated that the opposition to the arguments submitted to the Tariff Commission in behalf of the domestic industry fell into two classifications. The American company producing lead and zinc on foreign soil generally pleaded the case for free trade. The foreign company producer producing on foreign soil pointed to the potential harmful consequences and damaging effect that United States tariffs and import quotas would have on the economy of the country involved. No one among the opposition denied, however, that the American lead-zinc industry was not now suffering, said Mr. Schwab.

How Alaska Promotes Mining

The Spokane convention was a homecoming for the Territory of Alaska's governor, Michael A. Stepovich, a featured speaker at a noon luncheon. Big things are happening in our far northland, said the governor, who was educated at Spokane's Gonzaga University. Cinnabar today is one of the major items in our mineral production. The Red Devil mine in the Kuskokwim area is currently reported to be the largest single (mercury) producer in the United States. In 1956 it produced 14 percent of the United States' total production, and its reserves are still in the process of being outlined. Alaska has always been a mining territory, and though gold was once "king" by a wide margin, it now leads by a much slimmer margin, declared the governor. Today coal, chromite, platinum, and uranium are important resources now developed and in production. To attract private mining capital, Alaska for several years has offered a 3½-year exemption on mining license tax to new operations. A new law providing exemption from all Territorial and local taxes up to 10 years to new industries was passed in 1957. Mining operations are eligible for this program provided they do some of the processing in the Territory before shipment.

Speaking of Alaska, Phil R. Holdsworth, chief of the Alaska Department of Mines, said the compilation of our mineral resources has become so useful that an exploration chief for a mining company could spend four

or five days in our Juneau office and lay out his entire exploration program for the following season. Records of the Territorial Department of Mines involved the establishment of a central card system which could be kept current and contain all available information on any one deposit or prospect; the establishment of a system of quadrangles and quadrants; filing all correspondence concerning mineral information under the quadrangle system; and maintenance of a library of all United States Geological Survey and United States Bureau of Mines publications.

Dawn Uses Ion Columns

Dawn Mining Company's 440-ton-per-day column ion exchange uranium concentrating plant was described by Don Hargrove, assistant manager of the company. Though a leaf clarifier was originally installed in the plant to remove colloidal slime from thickener overflow, which formed IX feed, it has been found possible to by-pass the clarifier and send pregnant, colloidal slime-bearing solution to the columns. This was done by sizing resin in the columns within minus-20, plus-40-mesh limits and backwashing loaded resin prior to elution.

Bunker Hill Company's new west tailing area, where a dike will be built by a pipe distribution system, was described by Norman J. Sather. This, incidentally, is the first attempt of any large mining company in the Coeur d'Alene district to distribute tailing in this manner. Estimated cost of impounding tailing using pipe distribution is expected to be less than \$0.03 per ton, said Mr. Sather. The pipe system is mounted on a trestle which rings the disposal area on three sides, the fourth side being closed by the slag pile from the lead smelter. It is fed from a central distribution box on the east side. Tailing is discharged through 1-inch-diameter holes on 15-foot centers in the bottom of the distribution pipe. The trestle will be raised in 13-foot lifts.

The Reeves-MacDonald concentrator, designed for 64 tons per man-shift, including repairmen and staff, was described by J. C. Crampton of Pend Oreille Mines & Metals Company. Milling costs during the first 9 months of 1957 for 337,791 tons of ore milled were as follows:

Primary crushing	\$0.058
Secondary crushing	0.183
Milling and flotation	0.349
Reagents	0.200
Power	0.148
Other	0.055
Total	\$0.993

Also at Reeves MacDonald, John Parker reported to convention delegates, the cost of extending the incline shaft was \$118.00 per foot using the Cryderman mucker. This program started in March 1957.

Recovering the euxenite-bearing placer of Bear Valley, Idaho was the subject of a talk by Robert A. Lothrop of Porter Bros. Corporation. Porter Bros. Corporation is currently furnishing over 99 percent of our present domestic production of columbium-tantalum. Mr. Lothrop's fine paper pointed out the unique characteristics of this operation. A complete description of the dredging program of Porter Bros. Corporation appears in this issue of *MINING WORLD* starting on page 38.

Higher Stripping Ratios

The trend to higher stripping ratios and the role of the contract miner were discussed by John Isbell, Isbell Construction Company. He said that he knew of one uranium operation in Utah where the stripping ratio was 30-to-1. Mr. Isbell also said that his company figured on a job last year where the stripping ratio was 33-to-1 and the approximate cost of ore delivered would have been \$10 per ton, but that this was not good enough to keep the project from going underground. He did say, however that Isbell Construction Company will start work shortly on a project where the stripping ratio will be 36-to-1, and the ore mined price will be about \$9.50 per ton. In another area, the Reno contractor will supplement the underground production of a mining firm with development of a surface pit which will have an ultimate stripping ratio of 11.5-to-1, according to Mr. Isbell.

DMEA exploration in the Piedmont Province and Appalachian Mountain regions of the southeastern United States was described by Thor H. Kiilsgaard, United States Geological Survey. The Piedmont includes a belt extending from Washington, D. C., southwest across Virginia, North Carolina, and into Alabama, said Mr. Kiilsgaard. Geologic studies since the Korean War have shown that although some of the deposits occur in veins, many of them are large size replacement bodies of massive sulphides more or less conformable with the schistosity of the enclosing wall rock, according to Mr. Kiilsgaard. In summarizing the work of DMEA for the entire United States, Mr. Kiilsgaard said that about \$23.00 of potential ore has been found for each \$1.00 spent in exploration.

Richard M. Foose of Stanford Research Institute prodded the mining

industry slightly by calling for increased incentives for young, able engineers; for increased receptiveness to new ideas; and for increased research. He said that it was surprising that the industry was not more sophisticated in coping with its basic problems, such as minerals exploration. His solution was a broad four-point program: first, to create and support research activities within the structure of each organization; second, mining should support, on an industry-wide basis, programs of fundamental research dealing with major problems in earth sciences; third, the industry should give broader support to our academic institutions; fourth, the industry should seek to create a realistic and favorable environment within which to operate at all levels of governmental interest.

Zinc Blast Furnace

Joseph Newton, University of Idaho, discussed the blast furnace method for zinc recovery developed by Imperial Smelting Company at Avonmouth, Bristol, England. This revolutionary process was described by an article appearing in *MINING WORLD*, October 1957, pages 58 to 63. Mr. Newton's many years of experience in non-ferrous metallurgy qualified him to discuss this important development. At the conclusion of his talk Mr. Newton said, while holding up the October issue of *MINING WORLD*, "And if there are any questions, I have the article here to refer to."

An excellent Coeur d'Alene district shaft sinking symposium topped off the technical sessions Saturday afternoon. Specific details discussed at this meeting were too numerous to be fairly reported here. Participating in the symposium were William H. Love, Hecla Mining Company; E. B. Olds, Bunker Hill Company; Troy M. Tower, American Smelting & Refining Company; Charles A. McKinley, Sidney Mining Company, Wray D. Featherstone, Lucky Friday Silver-Lead Company; and Eric Erickson of the U.S. Bureau of Mines. The Silver Mountain shaft sunk by Hecla Mining Company and the Crescent shaft sunk by the Bunker Hill Company employed Riddell muckers. The Page incline shaft of American Smelting & Refining and the Lucky Friday shaft were extended using Cryderman muckers. The Sidney shaft bottom was cleaned using a Hydromucker.

Attendance at the convention continued to grow again this year. At last report it was estimated that 639 mining men had registered.

THE END

Idaho Placer

Continued from page 43

sumption totals one 50-gallon drum per day.

The system involves the use of a 6-inch pump to deliver pond water to the two settling tanks through a 6-inch plastic pipe line which contains a 100-foot length of 10-inch steel pipe. The steel pipe section is tapped with a total of five fittings spaced on 15-foot centers. Sulphuric acid is introduced through two of the fittings and Separan 2610 is introduced to the pipe through 3 fittings. Flocs form in the pipe while the slurry is enroute to the settling tanks.

The flocculated pulp is distributed evenly to two tanks measuring 50 feet long by 14 feet wide by 11 feet high. Both of these tanks are fitted with drag-type, endless rakes traveling on pulleys at each end of the tank. The flights, made of 8- by 6-inch redwood, are mounted on number 720 Promal chain. The rake mechanism operates under a 6-foot deep blanket of mud. Settled solids are scraped to the discharge port where the 8 to 10 percent slurry is delivered to a divided mud pond by a 4-inch Vacseal pump. The overflow from the settling tanks returns to the dredge pond. The settling tanks provide a residence time of about 2.15 hours. The rakes were designed by Link-Belt Company.

Leveling of Tailing

All leveling is kept as close to dredging as possible. Water purification requires a sizeable acreage of tailing for mud ponds. Generally about 20 acres is necessary for this purpose. Following the 1957 season, 32 acres of dredged land was leveled. The topsoil of the leveled tailing was replaced by stripping in front of the dredges and redepositing the soil on the smoothed tailing. Experimental seeding is being tried using combinations of alsike clover, meadow foxtail, smooth brome, timothy and intermediate wheat grass.

In a few years it will never be evident that the area has been dredged. The foregoing precautions are ample evidence of Porter Bros. Corporation's desire to restore the land to its native element. The Idaho euxenite operation is certainly unique and Porter Bros. Corporation is a credit to the minerals industry.

MINING WORLD thanks Porter Bros. Corporation for the opportunity to publish this article. The entire staff of Porter Bros. Corporation cooperated in its preparation.

THE END



AERIAL VIEW of new open pit mine and \$17,000,000 refinery of United States Borax & Chemical Corporation. The mine was

developed on the world's largest known sodium borate deposit. The plant covers an 80-acre site.

From Mule Teams to Rocket Age

U. S. Borax & Chemical Dedicates New Plant

United States Borax & Chemical Corporation dedicated its new open pit mine and refinery November 13, at Boron, California, before a crowd estimated at over 2,000 visitors and guests. The dedication culminated a \$20,000,000 project that began over two years ago when Isbell Construction Company began stripping activities to remove an initial 10,000,000 tons of overburden from the deposit.

The sprawling new refinery spreads out over 80 acres, and this facility alone represented an expenditure of some \$17,000,000. It was designed and constructed as a joint venture by Southwestern Engineering Company and Ford J. Twaits Company. The entire project will expand United States Borax & Chemical's capacity by 30 percent. Treatment involves digestion of the ore in steam jacketed vessels followed by vacuum crystallization of borax. The new plant contains four, 230-foot diameter, totally enclosed



JAMES M. GERSTLEY, president, U. S. Borax & Chemical. Dedication brings back memories of 20-mule team.

and insulated thickeners, largest of their kind in the world.

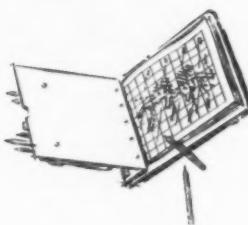
The open pit replaced mechanized underground extraction of borax using continuous mining machines, shuttlecar and belt conveyor haulage to the shaft. It will enable U. S. Borax & Chemical to extract 100 percent of the ore body. The deposit is the largest known sodium borate deposit in the world. Currently U. S. Borax &

Chemical is furnishing about 70 percent of the free world output of borax.

The dedication ceremonies marked a day of complete contrasts and signalled the opening of a new era for the company. A team of 20 mules was on hand to haul a symbolic last load of borax from the new pit—just as it was done prior to 1900 when the ore was hauled 165 miles across the blistering desert from Death Valley to Mojave. As the ceremonies neared an end, a flight of supersonic jet planes flew overhead in a salute to the new facilities. The presence of the jets significantly reminded everyone of the potential value of boron in high energy fuels.

Participating in the dedication were James M. Gerstley, president, of U. S. Borax & Chemical; Hatfield Chilson, Under Secretary of Interior; California's Lt. Governor Harold I. Powers; and representatives of the Air Force and Navy.

From a Geologist's Notebook



Bunker Hill Buys Red Bird Mine

This new chapter in the history of a famous old lead mine recalls to the geologist the silver-lead belt of south central Idaho. The Red Bird is but one of many silver-lead-zinc properties; some others are the Bullion, Minnie Moore, Queen of the Hills, Triumph, Elkhorn, Vienna, Galena, Livingston, Clayton, Ramshorn, Pacific and Ella. Map-wise, they fall into a "live zone" that extends from south of Hailey in the famous Wood River Valley of Blaine County, northward over a high divide to near Challis on the East Fork, Salmon River in Custer County.

Mining began here in the 1860's but, although rich surface ores were quickly found, growth was handicapped by the poor transportation in these mountains. Small smelters to handle oxide ores were built at Hailey, Bullion, Ketchum, Clayton, and Bayhorse, and operated for various periods of five to 20 years. Changing conditions of better transport, and more complex ores, caused their demise. The belt has been characterized by surges of interest and development with alternate dead periods. Mines have been found, ostensibly worked out, reopened and once again shut down, but the belt as a whole has seldom been without one or more substantial silver-lead-zinc operation in progress.

The "live zone" extends along the structurally complex region just east of the great Idaho Batholith. For the most part, ore deposits are lodes and lesser replacements of carbonate rocks in host formations of Paleozoic age. Base metals appear to have been introduced in late Mesozoic or early Tertiary times, more or less coexistent with the batholithic invasion. By Miocene time, deep erosion had revealed many deposits at the surface and oxidation extended to hundreds of feet in depth. A mature topography with deep wide valleys and broad uplands existed. Then Miocene volcanism drowned the area, covering most if not all of the old land surface with thousands of feet of volcanic rocks. Since then, repeated structural disturbances, uplift and down-cutting by local glaciation, and streams, has fashioned the rugged landscape of today. Although the Miocene and younger rocks are broken by faults, and although these rocks do contain gold and fluorite deposits, it is the structures restricted to the older rocks that localize the "live zone".

These older structures are complex. Invaded by granitic igneous masses as are the old rocks, and drowned as is the entire area by post-ore volcanics, the structures are difficult to trace or decipher. The "live zone" is located at the western margin of the calcareous sedimentation trough that occupied parts of eastern Idaho and western Montana from Cambrian to Pennsylvanian time. The major and minor ore localizing structures are at least post-Permian in age.

In the Wood River district, a structural high exposes pre-Cambrian and Ordovician rocks as a window through a complex of low angle thrusts, whose upper plates consist of black argillite Milligan formation and the diverse Wood River formation. Here most of the deposits are in upper plate rocks in complex structures at least in part related to thrusting. To the north, in the Salmon River country, the structural high becomes a group of steeply flanked anticlines exposing Ordovician and older rocks in the center, flanked on the east by limestones of Devonian and younger age, but on the west by the argillaceous Milligan and Wood River formations. High angle dips, abrupt changes in attitudes, strong faulting, dike intrusion and extremely complex structure mark the belt.

The Red Bird and Clayton mines lie on opposite limbs of the Saturday Mountain anticline in quartzites, argillites and dolomites of Ordovician age. The Clayton mine deposits are along the steeply dipping east flank in a breccia zone in and between quartzites and dolomites. Ore shoots form elongate pipe-like masses of substantial known vertical range and good horizontal dimension. Several million tons of ore containing galena, sphalerite, lesser amounts of pyrite and tetrahedrite in a gangue of country rock, siderite, and quartz have already been extracted. Clayton Silver Mines, Inc., the operator since 1937, continues in production.

The Red Bird was an early discovery and was actively operated from 1878 to 1902. During each of these years, between 1,000 and 1,500 tons of sorted ore were shipped to the old customs smelter at Clayton. The shipments, largely cerussite-anglesite ores, averaged 30 to 40 per-

cent lead and 40 to 60 ounces of silver per ton. They came from the upper levels of the mine to depths of 400 feet. In 1902 the property shut down, but was operated by various leasers from 1912 to 1924, when the Ford Motor Company, desiring its own "independent" source of lead, optioned the property. At that time, the mine was developed by nine levels, through a vertical range of over 700 feet. The lowest adit level, No. 8, is a cross-cut some 1,600 feet from the east bank of Squaw Creek, through the Saturday Mountain formation, to the so-called vein structures. All in all, there were more than two miles of workings and Ford was to add much more.

Ford conducted an extensive program of underground work, drilling and metallurgical testing, climaxing in acquisition of the property in 1926, but Ford never operated the mine. In 1946, it passed into the hands of Breckon, Norden and Buchman, engineers well known to the mining fraternity at Salt Lake City, Utah. This group operated the property for some time, shipping sulfide and mixed ores and dump ores to Salt Lake Valley smelters, but no extensive exploration campaign was undertaken and no unknown ore discovered.

In recent years the "live zone" has seen extensive exploration activity at the Beardsley, Ramshorn-Pacific groups, the Livingston, the Hoodoo, the Lucky Strike, the Triumph and other properties by such strong companies as American Metals Company, American Smelting and Refining Company, Sunshine Mining Company, and Hecla Mining Company. No great successes have resulted and the northern part of the "live zone" has, as a natural result, received a bad name. To our knowledge however, no detailed structural studies, and no district geologic studies have been made. Mineral deposits are found in veins related intimately to complex structures or in breccia zones, or in closely fractured zones within sympathetic host rocks in areas of known mineralization and strong deformation. There is need in the area for intense structural study. With its strong past production records, mostly from ores that actually crop out and the widespread evidence of long continued mineralization, this belt cannot be written off. A new major mine will surely be found here sooner, not later. Perhaps under Bunker Hill direction, the Red Bird may be it.

But perhaps it may not be a lead or a zinc mine. In the same belt many other metals are found and Salmon River Scheelite has found what seems to be a substantial tungsten ore body of interesting grade along a small part of a granitic contact known to be mineralized some 25 miles.

So, it seems premature to condemn the silver-lead belt of south central Idaho; it is still in the "live zone".



United States

Personalities in the News



CLARENCE G. CARLSON has been appointed manager of the new mining division established by Yuba Consolidated Industries, Inc. of San Francisco to maintain a newly created exploration department, handle engineering, manufacture and sales of mining

equipment, and manage Yuba Consolidated Gold Fields and Portuguese-American tin operations. Mr. Carlson was formerly employed as a petroleum engineer with the General Petroleum Corporation. J. J. THEISSEN will work with Mr. Carlson in the company's exploration activities.

Raymond G. Lindlof has accepted a position as chief engineer and geologist for Federal Uranium Corporation in Salt Lake City, Utah. Mr. Lindlof served with Hecla Mining Company as geological engineer and shift boss for several years, and more recently was employed by the Atomic Energy Commission at Casper, Wyoming as geological engineer.

Carleton Savage, economic geologist, and **Richard S. Kopp**, minerals analyst, have joined the staff of the Idaho Bureau of Mines and Geology. Dr. Savage was formerly associate professor of geology at the Kent State University in Ohio, and Mr. Kopp was previously associated with the United States Geological Survey in Nevada.

C. P. Finlayson, geologist, has accepted a position with the Tennessee Geologic Survey with offices in Knoxville. Mr. Finlayson had been employed by the American Smelting & Refining Company.

Douglas R. Mabey has been promoted to contract engineer with Kennecott Copper Corporation's Utah Copper Division. Mr. Mabey was previously employed as design engineer in the company's Western Mining Divisions Engineering Department.

Russell G. Haworth, vice president in charge of production and resident manager of Potash Company of America, was recently elected to the company's board of directors, filling a vacancy left by the death of C. K. Boettcher last June.



GEORGE E. KRUGER, consulting mining geologist, has accepted a position with the staff of the Chase Manhattan Bank in New York City, as mining geologist. Mr. Kruger was formerly associated with the Cerro de Pasco Corporation and Ventures Limited of Toronto, Canada, and has served as a consultant in mining geology in South America. Most recently, Mr. Kruger maintained a consulting office in New York City.

Matt Laughland has been promoted to mine maintenance foreman for the Southwest Potash Corporation's operations in Carlsbad, New Mexico. Mr. Laughland has been employed in the mine maintenance department since November 1952.

R. H. Taylor recently resigned as assistant chief engineer for Climax Molybdenum Company at Climax, Colorado to accept a position with Duval Sulphur & Potash Company, as mine superintendent of the company's operations in Carlsbad, New Mexico.

R. S. Shreve was recently appointed mill superintendent of Kerr-McGee Oil Industries, Inc.'s uranium processing mill at Shiprock, New Mexico. Mr. Shreve has been associated with the Shiprock plant for the past three years, serving as assistant mill superintendent.

J. Ranald Fox has been named assistant general manager of the Aluminum Company of America's refining division at Point Comfort, Pennsylvania. A. B. Kaltwasser, former plant production manager at Point Comfort, will succeed Mr. Fox as works manager.



Newly elected officers of the New Mexico Mining Association are (left to right) **RUSSELL G. HAWORTH**, vice president and resident manager of Potash Company of America, Association president; **T. O. EVANS**, chief mining engineer for the Atchison, Topeka, and Santa Fe Railroad, Association vice president; and **A. L. GRESLIN**, general manager and superintendent of the Molybdenum Corporation of America, also Association vice president. The election was held at the recent Mining Days and Convention sponsored by the Association in El Paso, Texas.

David F. Shaw has been appointed vice president of Kaiser Engineers, a division of the Henry J. Kaiser Company, at Oakland, California.

W. Aubrey Smith, general manager of Southwest Potash Corporation's operations in Carlsbad, New Mexico, was recently elected a vice-president. **V. Zandon**, former assistant general manager, was promoted to general manager and **John Sowers** was promoted from mine superintendent to general superintendent of the Southwest property.

Clyde W. Nicolson, consulting engineer for North Range Mining Company in Negaunee, Michigan, since 1941, retired recently. Mr. Nicolson plans to remain in Negaunee.

Gordon Campbell has been promoted to plant foreman at the M. A. Hanna Company's Perry mine on the

HOWARD L. WALDRON, professor of mining engineering at the University of North Dakota, Grand Forks, North Dakota, has been retained as special engineering editor for MINING WORLD. Mr. Waldron, former field editor and New York district manager for MINING WORLD, is already well known to many readers. His first article in his new assignment, "J & L Dredges Iron Ore Tailing for New Spiral Flotation Plant," appears in this issue.



Mesabi range. Mr. Campbell was previously maintenance mechanic at the Carls iron mine.

Everett L. Joppa has been named general manager of Pickands Mather & Co.'s Superior Mining Division, following the incorporation of Erie Mining Company's commercial taconite plant with Pickands Mather's iron ore operation. **Donald M. Chisholm** is general manager of the division, **L. E. Johnson** is works manager, **O. L. Yauch** will be manager of engineering and mine development, and **Sevel C. Sorenson** has been named chief mining engineer in the Duluth office. **C. S. Arms**, present manager of mining plans and controls for the iron mining division, will assume the same responsibility for the taconite operations.

Bayard J. Squire has resigned as field engineer with the Arizona Department of Mineral Resources in Phoenix, to accept a position with Roberts & Associates, an engineering and mining concern in Los Angeles, California. Mr. Squire will continue to make his headquarters in Phoenix.

Charles H. Segerstrom, Jr., president of the Nevada-Massachusetts Company at Tungsten, Nevada, has been elected president of the American Tungsten Association. Mr. Segerstrom has opened an office in Sonora, California to represent the tungsten association and the Western Governors.

Professor William W. Staley, of the University of Idaho at Moscow, Idaho, has returned to this country after spending a year's leave of absence in Korea, helping to set up a modern engineering program at the Seoul Na-

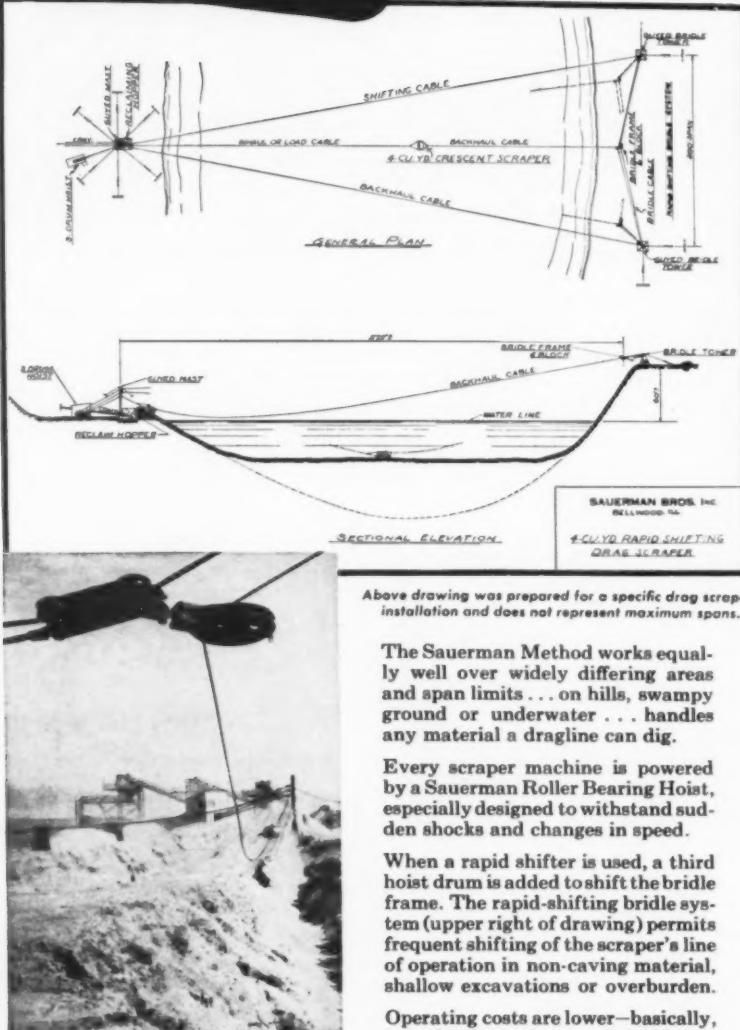
ALFRED J. DICKINSON has accepted a position as vice president and sales manager of Freeport Sulphur Company in New York City, succeeding the late **ROY B. JOHNS**. Mr. Dickinson was formerly employed by the Virginia - Carolina Chemical Corporation

as vice president. He is a graduate of the University of Richmond and of Harvard University Graduate School of Business Administration.



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tional University. The trip was sponsored by the University of Minnesota, the Seoul National University, and the International Cooperation Administration.

Harry M. Feigin, property superintendent of the International Minerals & Chemical Corporation's Florida Department Phosphate Minerals Division at Bartow, was recently promoted to coordinator of organization planning in the company's Industrial Relation Department in Chicago, Illinois. J. Roy Hall formerly company geologist with headquarters in Columbia, Tennessee, will succeed Mr. Feigin as property superintendent.

Obituaries

Wilbur Frank Allen, formerly of the Old Smuggler Union Mining and Milling Company at Pandora, Colorado, died recently in Los Angeles, California. Mr. Allen was the inventor of the Allen-Reid flotation cells which were in operation for many years at the Old Smuggler Union Mills. After retiring from active mining, Mr. Allen served as consulting engineer.

George O. Argall, pioneer Colorado mining engineer, died recently at his home in Denver, Colorado. Mr. Argall was, at one time, manager of the Leadville Deep Mines Company and Leadville Zinc Lead Company in Colorado, consulting engineer and treasurer for the Penn Mining Company in California, and at the time of his death maintained a consulting engineering office in Denver.

Theodore W. Becker, geologist, was killed recently in a helicopter crash at Rawlins, Wyoming. Mr. Becker was employed with the Mining Division of the Union Pacific Railroad at the time of his death.

Edward J. Byrnes, Jr., assistant general manager of sales for the Colorado Fuel & Iron Corporation's Eastern Division, died recently at Palmer, Massachusetts.

Dr. Paul Dyer Merica, former president of the International Nickel Company of Canada, Ltd. and the International Nickel Company, Inc., died recently in Tarrytown, New York. Dr. Merica was best known for his contributions to theoretical metallurgy.

John C. Metcalf, mining engineer, died recently in a Duluth, Minnesota hospital. Mr. Metcalf was assistant general manager for Pickands Mather & Co. when he retired in 1955.

LeRoy Salsich, former president of the Oliver Iron Mining Company, died recently in a Duluth, Minnesota hospital. Mr. Salsich joined Oliver's staff in 1902 as chief engineer and was elected president in 1930, a post he held until his retirement.

Martin Taylor, general mill foreman with Pima Mining Company, was killed recently in an accident at the Pima mine in Arizona.

John W. (Jack) Thompson, former vice president in charge of field operations for the Galigher Company, died recently at Salt Lake City, Utah. Mr. Thompson was active in the development of milling processes and, in a partnership with Lionel E. Booth, developed and marketed the "Agitar" flotation machine.

Newsmakers

in International Mining—

JOSEPH J. CONEY is head of Coney Argentina S. A., which recently purchased 2,300,000 acres of land with extensive mineral reserves in the Mendoza Province of Argentina. Mr. Coney is also president and director of the Gold Hill and Wallace Dredging Companies, in the United States, and has been engaged in development of oil and mining interest in Central America for the last 20 years. Mineral deposits on the newly acquired land include silver, lead-zinc, iron ore, as well as gilsonite and asphalt, with some mines already in production.



Professor Recep Safoglu, formerly of Ankara, Turkey, has joined the mining faculty of the Technical University of Istanbul and is now residing in Levent, Turkey.

W. K. Brown, mining engineer, and **F. Jaffe**, geologist, have accepted positions with the Union Carbide Ore Company in New York City. Both men were formerly employed by the Surinam Mining Company in Paramaribo, Surinam.

Dr. E. B. Gillanders has been appointed to the newly created position of executive vice-president of Rio Tinto Mining Company of Canada, Ltd. **H. E. Nelems** was selected to succeed Dr. Gillanders as vice-president in charge of operations. Mr. Nelems will be responsible for the operations of all companies under the management of Rio Tinto. Dr. Gillanders will handle administrative and supervisory responsibilities of all divisions.

T. H. Bradford, chairman of directors of the Rhodesian Selection Trust Group recently visited operations of Chibuluma Mines, Ltd., Roan Antelope Copper Mines, Ltd., and Mufulira Copper Mines, Ltd. in the African Copperbelt.

Chae Whan Lee, mine manager of the Korea Tungsten Mining Company's Dal Sung mine in Daegu, Korea, was recently transferred to the Sang Dong mine in Young Wol Gun. **Kwan Chul Chung** was also transferred from the Dal Sung mine to Sang Dong operations.

W. A. Hutchison is now general manager of the Phelps Dodge Corporation of Canada, Ltd., with headquarters in Toronto. Mr. Hutchison previously served as managing director of Northspan Uranium Mines, Ltd. and Preston East Dome Mines, Ltd.

Sixten Wohlfart, director of the Domnarvet Company in Sweden, has been appointed president of the Swedish Iron Works Association, succeeding **Evert Wijkander**.

Joseph C. Allen, formerly assistant general superintendent of plants with the Chile Exploration Company in Chuquicamata, Chile, has been promoted to general superintendent of plants. **David Sanders**, former con-

centrator superintendent of the company's sulphide plant, will take over Mr. Allen's previous position. Mr. Sanders will be succeeded by **Charles M. Lagergren**, who has been serving as chief chemist. **Francis Jones** was promoted to assistant to the concentrator superintendent and **Peter Hobbs** will replace him as concentrator general foreman.

John Payne, Jr., vice president of American Metal Company, Ltd., recently toured mining operations of the Rhodesian Selection Trust Group in the Africa Copperbelt. American Metals has important interests in the Selection Trust Group properties.

Wilhelm Haglund has accepted a position as technical manager and vice president of the Sandviken Iron Works Company in Sweden.

William J. Daly, mill superintendent of Can-Met Explorations, Ltd. at Toronto, Canada, will also assume responsibility as assistant mine manager.

A group of men representing Spain's iron ore industry visited iron mines in the Gogebic Range in the United States recently. Included in the group were **Pablo Alarco**, technical manager; **Eduardo Gamir**, mining engineer; **Antonio Martinex**, technical secretary; **Serafin DeLa Concha**, mining engineer; and **Manual Pastor**, mining engineer.

James Sinclair, former underground manager at Roan Antelope Copper Mines, Ltd., Northern Rhodesia, is now assistant manager of Chibuluma Mines, Ltd., also in Northern Rhodesia.

Harold Hicks has been appointed superintendent of Steep Rock Iron Mines, Ltd.'s new concentrator now under construction in Ontario, Canada. He is succeeded as chief geologist by **William J. Huston**.



A group of African Copperbelt concentrator superintendents met at the Roan Antelope Copper Mines, Ltd.'s flotation plant in Luanshya, Northern Rhodesia recently to discuss problems of common interest. Pictured here, from left to right, are **M. R. GOLDICK**, concentrator superintendent, Roan Antelope; **G. KEARNEY**, assistant concentrator superintendent, Rhokana Corporation, Ltd.; **D. McLOED**, concentrator superintendent, Rhokana; **A. FINN**, concentrator superintendent, Mufulira Copper Mines, Ltd.; **B. BARLIN**, assistant concentrator superintendent, Bancroft Mines, Ltd.; **L. FOULKES**, assistant concentrator superintendent, Roan Antelope; **DR. WIGHTMAN**, assistant concentrator superintendent, Mufulira; **F. FITZGIBBON**, concentrator superintendent, Nchanga Consolidated Copper Mines, Ltd.; and **J. HARPER**, concentrator superintendent, Chibuluma Mines, Ltd.

DR. JOHN F. THOMPSON, chairman of the board of the International Nickel Company of Canada, Ltd., Toronto, Canada, has been chosen to receive the American Institute of Mining, Metallurgical, and Petroleum Engineers' Charles F. Rand Memorial Medal for 1958. The award is given for "distinguished achievement in mining administration" and will be presented at the annual AIME banquet in February. Dr. Thompson joined International's staff in 1906 as metallurgist, was elected president in 1949, and in 1952 relinquished the presidency, continuing as chairman of the board and chief officer of the company.



F. H. Y. Bamford, director of South African Manganese, Ltd., is currently visiting Europe and the United States, for discussions on future contracts for the sale of manganese ore.

P. L. Hoogenhout has been appointed to the board of Rand Selection Corporation, Ltd. in the Union of South Africa.

J. Thomson, formerly general manager of Roan Antelope Copper Mines, Ltd., has been transferred to London, England where he will serve as head of the Rhodesian Selection Trust Services, Ltd.

I. M. Campbell-Rodger, formerly manager of Johannesburg Consolidated Investment, Ltd. in Johannesburg, Union of South Africa, has been promoted to deputy general manager. **W. S. Findlay**, consulting engineer, has been appointed as one of the Johannesburg managers of the company.

E. J. T. Goudie is now a member of the London Advisory Committee, Rhodesian Selection Trust Service, Ltd., Roan Antelope Copper Mines, Ltd., and Chibuluma Mines, Ltd.

A delegation of the Labor Administration of Chile and Washington, D. C., toured United States mining operations on the Mesabi range recently. Included in the group were **Borio Yopo**, **Carlos Espinosa**, **Juan Ponce de Leon**, **Humberto del Pino**, **Roberto Oyanedes**, of Santiago, Chile and **Ernesto Naumann** of Ancud, Chile.

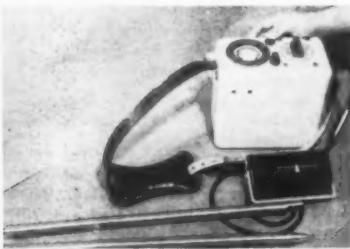
Luis A. Nogales, Bolivian mining consultant, is now employed with Cia Dominicana de Minerales in the Dominican Republic as chief of the Geophysical Exploration Department.

S. B. P. Mangunsong, general manager of the Banka Tin Mines, Inc. in Republic of Indonesia, and **J. N. Bernardus**, general superintendent, visited mining operations in the United States recently as guests of Eimco Corporation. Their trip to America was sponsored by the International Cooperation Administration.

J. T. Holman has resigned as a director of Climax Rock Drill & Engineering Works, Ltd. He will be replaced by **F. F. L. Morgan**.

PRODUCTION EQUIPMENT PREVIEW

PEP is just what new equipment, increased mechanization, and new methods can give to your mine, mill or smelter. This PEP section is MINING WORLD's way of making available to you some of the finest current information on mechanization.



New Varian Magnetometer Packaged for Portability

The new Varian M-49 portable (16-pound), proton-free, precession magnetometer is compact, carefully sealed, easy to operate, and not affected by weather changes.

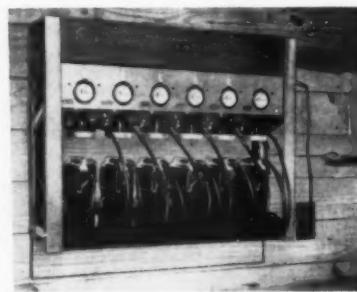
No temperature compensation is necessary, no calibration is needed, and no orientation is required for its use. It will give an absolute value of the total intensity of the earth's magnetic field to an accuracy of plus or minus 10 gammas. Six plug-in tuning units give a range from 19,000 to 81,000 gammas.

The sensing head can be as close as three feet or as distant as several hundreds of feet from the electronic package. And it operates accurately in both cases. This means multilevel measurements from balloons above the earth or underwater observations with the same instrument.

Circle PEP No. 50 for full details on this new tool for geophysical exploration.

water emulsion of synthetic resin, forms a tough crust when sprayed on the surface of the fines preventing wind or rain erosion.

Reagent S-3152 is a water emulsion, milk-white in appearance. It is non-corrosive and can be infinitely diluted with water to make any strength spray desired. Samples of this new reagent and technical notes on its use are available on request. Circle No. 59.



Wheat Six-Lamp Charger Is Now Available

National Mine Service Company, 564 Alcoa Bldg., Pittsburgh, Pennsylvania, has introduced a new Wheat six-lamp charger that provides flexible taper charging previously available only for installations of 50 or more lamps. From one to six lamps may be charged simultaneously with the Wheat unit. Lamps in use for one or two hours may be charged with others that have been in use for eight to ten hours. All will get a satisfactory charge without any setting of timers, rheostats or other adjustments. For further information write the company direct using handy reader service card.



Film Forming Reagent Prevents Loss of Fines

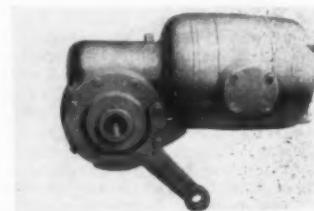
The Mining Chemicals Department of American Cyanamid Co. offers a new product for forming protective crusts over mineral fines either in stockpiles or in open railroad cars. Reagent S-3152, a

either a conventional truck or a passenger car may be inadequate. It is available in a variety of models including a four-wheel-drive model, and will handle up to full ton loads. Write to company at 180 N. Michigan Ave., Chicago, Illinois. Use reader service card.



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Groups of wires, tubes, pipes and hoses can be protected by Zippertubing from abrasion, corrosion, critical environmental conditions and excessive wear by the use of this plastic jacket with its zipper-type closure. Not only can the encased hoses or pipes be clearly and simply identified but installation is quick and easy with any zipper-operated item. For copies of a new Zippertubing brochure, circle No. 58.



Six Passenger Pickup Truck by Harvester

The Travelette, a handsomely custom styled International pickup truck with six-passenger cab, has recently been introduced as a combination passenger-cargo carrier by the motor truck division of International Harvester Co. The new unit is designed as a double-duty vehicle to meet many industrial, commercial and family transportation requirements where

Shaft Mounted Right Angle Gear Motors

Sterling Electric Motors, Inc., 5401 Telegraph Road, Los Angeles 22, California, has made available a new line of Shaft Mounted Right Angle Gear Motors from $\frac{1}{2}$ through 5 hp. This shaft mounted design is a simple and efficient method of installation as it eliminates all intermediate transmission elements, such as couplings and sprockets. Coupled with the weight saving characteristics of aluminum construction, these gear motors provide a compact, space saving installation especially suitable for lighter pieces of machinery or use in small areas. For more information write company at above address. Use reader service card.

STOP LOSSES OF FINES: A new film-forming water emulsion of synthetic resin that stops wind and rain erosion when sprayed on fines in railroad cars or in stockpiles, is available from the Mining Chemicals Department of American Cyanamid Co. Samples of the new reagent, called Reagent S-3152, and technical notes on its use are available. Circle No. 8.

SELF CLEANING CONVEYOR PULLEYS: Van Gorp Manufacturing Co., Inc. announce an addition to their manufacturing lines to include steel self-cleaning conveyor pulleys that are now immediately available in 3,000 standard sizes. Sizes range from 8" to 60" in diameter and from 8" to 66" in face width and bore sizes from $\frac{1}{2}$ " to 10". Circle No. 5 for additional information.

THE INDUSTRIAL pH HANDBOOK: The Process Instruments Division of Beckman Instruments, Inc., announces the availability of "The Industrial pH Handbook." This 80-page handbook is the first manual ever published giving such thorough coverage of industrial pH information under one cover. Price: \$2.00/copy. For copies write to Beckman/Process Instruments Division, Fullerton, California, U.S.A.

THUNDERBIRD is the name of a new brand of wire braid hose manufactured by Thermoid Company, 200 Whitehead Road, Trenton 6, New Jersey. Capable of withstanding working pressures of up to 400 psi air and 2,000 water, the hose features a Neoprene tube compounded to resist hot or cold oil with flaking or swelling. Write company for additional information. Use reader service card.

TREFOIL INDEX: Denver Equipment Co., Box 5268, Denver 17, Colorado has published an index of articles appearing in Deco Trefoil for the years 1955 and 1956. Also included is a complete index of technical bulletins published in Trefoil for the years 1938 through 1956 classified by companies featured and also by minerals. Obtain your copy by writing to the company at the above address. Use handy reader service card.

MAKE MINE SAFETY: is the title of a new 16 mm sound-color motion picture recently released by The Colorado Fuel & Iron Corporation. The film entertainingly gives the facts about rock bolts, how and where they can be used to best advantage for maximum efficiency and safety. Prints may be obtained for showing, without charge, by writing to the producer, Thomas J. Barbre Productions, 2130 South Bellaire St., Denver 22, Colorado.

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MARTINDALE Electric Co. now has available for you a free 64-page catalog #31, which includes complete information for selecting and ordering metalworking tools, motor and generator maintenance equipment, flexible shaft machines, safety equipment, and scores of electrical and mechanical maintenance products. Circle No. 3 for your copy.

DURACLONE: H. B. Large Engineering Co., 262 S. Parkwood Ave., Pasadena California, has available some interesting literature on their low cost dewatering Cone. A wide variety of sizes are described. Technical data and price information of the rubber-lined Duraccone are given. Write company direct using handy reader service card.

LABORATORY SIZE ore dressing equipment is available from the Booth Co., 333 West 14th South St., Salt Lake City 13, Utah. Bulletins are available describing their full line of equipment ranging from flotation machines, ore testing services, to pressure filters and lab ball mills. Send for catalog describing full set of bulletins available. Write company direct, at above address, using handy reader service card.

A NEW SPRAY has been developed by The Johnson-March Corporation which blankets and effectively protects outdoor storage piles of bulk materials against all types of weather conditions for periods up to a year or more. Called Permaspray, the product is a colloidal suspension in water of a special chemical which forms a tough, flexible, water-resistant film when exposed to air and hardened. It is suitable for coating stock piles and all types of materials in dead storage regardless of composition or particle size. Circle No. 4 for further information.

A NEW BOOK describing Link-Belt Company's complete line of improved geared flexible couplings has just been released. The 12-page book #2775, describes application and selection data for couplings with maximum bores ranging up to seven inches and ratings from 28 to 572 hp per 100 rpm. Use reader service card and write Link-Belt Co., Prudential Plaza, Chicago 1, Illinois, for your copy of this book.

ANTI-FRICTION TYPE CRUSHER: Denver Equipment Co. announces production of the new all anti-friction bearing type "H" Denver Jaw Crusher in sizes 5" x 6", 8" x 10", 10" x 16" and 10" x 20". All crushers have cast steel frames. According to the company anti-friction bearings mean cooler runs and longer bearing life. For additional information use reader service card and write DECO, P.O. Box 5268, Denver 17, Colorado.

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Two New Self-Priming Air-Powered Sump Pumps

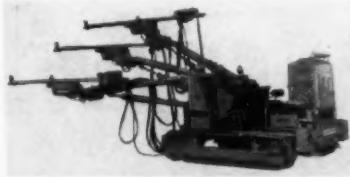
Two new sump pumps, with capacities ranging from 222 gallons per minute at a 30-foot head to 20 gallons per minute at a 200-foot head, have been added to the wide range of pneumatic equipment offered by Atlas Copco. Both models weigh approximately 50 pounds, are only 22½ inches high, and operate on pressures of 85 psi. They can be used for pumping clear or dirty water, oil and moderately heavy sludge, with ability to start under full loads and operate even when wholly submerged as additional features. Write Atlas Copco Pacific, Inc., 930 Brittan Ave., San Carlos, California, for additional information. Use reader service card.



All Operations Controlled From Platform in New Unit

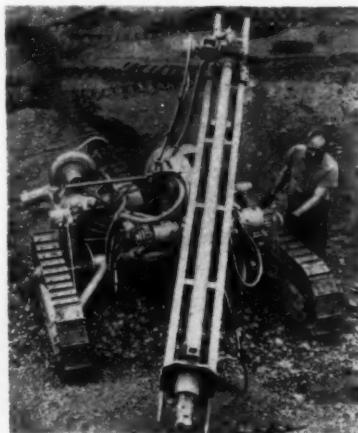
Pitman Manufacturing Company, Kansas City, Missouri, is making a new aerial platform that is self-propelled, and with all operations controllable from the platform. Called the Travel Tower it is a 3-wheeled vehicle with a capacity of 250 pounds on the platform regardless of boom position. The man on the platform

can drive the machine forward and reverse, steer it, raise and lower the boom, also swing the boom through an arc of 36°. All operations except the forward and reverse drive are foot controlled, leaving the operator's hands free. Circle No. 52 on the reader inquiry card.



Push-Button Drilling by Gardner-Denver

Developing further its conception of "push-button" rock drilling, Gardner-Denver Co., Quincy, Illinois, has just announced the new Model JMT "Mobil-Jumbo." According to Gardner-Denver engineers, the new JMT self-propelled, crawler-mounted jumbo puts rock drills under fingertip control at the operator's position. It is available with crawlers powered by either Diesel-hydraulic drive or by five-cylinder radial air motors. An electric generator, air motor driven, supplies three lights that flood the working face and the drilling operation. Write the company at above address for the whole story. Use reader service card.



New Large Diameter Drill Is Track Mounted

Here is a new percussion type rock drill manufactured by Reich Bros. Mfg. Co., Inc., Terre Haute, Indiana. This self-propelled drill, called the 150 Blast Hole Driller, can drill a four-inch hole and swing 150 degrees both in a vertical and horizontal arc. Fast drilling results from the efficient combination of rotary drilling plus a continuous hammering action on the end of the drill. Supporting the drill at the drive end is a standard, hollow shaft Cone-Drive speed reducer which also drives the drill from a hydraulic motor. The drill rotates at 80 rpm, and compressed air is used for the hammering action on the end of the drill. Write to the company for additional information. Use reader service card.

Notes From The Manufacturers



Expansion of the Gardner-Denver Company's plant in Rio de Janeiro, Brazil has been completed, as illustrated above. The enlarged plant has 22,000 square feet of modern manufacturing and office space. At full capacity it will produce parts for and assemble rock drills, pumps, compressors and air tools to be used in South American industries.

American Cyanamid Company has announced the change in name of its mineral dressing department to mining chemicals department. This department manufactures and sells chemicals which are used throughout the world for the processing of ores and non-metallic minerals; and provides technical services through an international force of engineering field representatives.

J. V. S. Norton has been appointed assistant export sales manager of Bucyrus-Erie Company, South Milwaukee, Wisconsin. He has been associated with the company in the New York export sales department office since 1945.

Don S. Permar has been named to the newly created position of assistant general sales manager for the Le Roi Division, Westinghouse Air Brake Company.

Lake Shore, Incorporated, in Iron Mountain, Michigan has signed an agreement with the Swedish mining machinery firm A. B. Nyhammar Bruk, granting Nyhammar exclusive authority to manufacture and sell Lake Shore's bottom dump skip in Sweden, Norway, Denmark and Finland. Permission to sell, but not to manufacture, the skip in other countries outside the United States and Canada is included in the agreement. The bottom dump skip is sold under the trademark "Jeto."



A. C. DAMAN (left), president of the Denver Equipment Company, Denver, Colorado, and JUNZO KURIKOMOTO, chairman of the board of Kurimoto Iron Works, Ltd., Japan, discuss final negotiations for the manufacture of Denver machines in Japan. Mr. Kurimoto arrived in Denver to make the final arrangements after the project had been approved by the Japanese government.

TD-24 "strips" at lowest of any crawler on the

reports Morris Enterprises, Owensboro, Kentucky

Upgrade, downgrade, or on the level, famous Planet Power steering gives you positive and constant load control on turn or straightaway. And this planetary system that gives full-time "live" power on both tracks lets the TD-24 pull the same big loads on turns as on straightaways! Morris Enterprises owns this TD-24 that's stripping overburden near Knottsville, Ky.

Benching or 'dozing around curves is a cinch for the TD-24. TD-24 two-track turning power never backs off from the load—and does not let the load "fish-tail" the tractor or slip the tracks! Instead you "feed" power to both tracks to keep the full productive push where you want it!



cost per cu yd market...



On this stripping operation near Knottsville, Kentucky, Morris Enterprises are moving a maximum of 45 feet of overburden—to uncover a 42-inch coal seam. Overburden is a 5 to 10-foot earth layer; the balance, shale and soapstone.

An International TD-24 dozer is moving 50% of the overburden on a 60 to 70-foot wide cut ahead of shovel operation. A 3½-cu. yd. shovel moves the other 50%.

"This kind of performance sold me"

"**Have been using International TD-24's since 1950;**" reports P. H. Morris, for Morris Enterprises. "The TD-24 has proven able to move dirt cheaper per cu. yd. than any other track-type tractor. Upkeep has been low and TD-24 ease of operation enables the operator to maintain full production—after hours of continuous dozing.

"Live power on both tracks while turning is a definite advantage for full load maneuverability. And shifting on-the-go speeds up the production.

"One of the TD-24's ran 7,500 hours before major overhaul on rails, shoes, and engine. Still in use with original rollers and sprockets.

"This kind of performance sold me on TD-24's for my operation."

See how you 'doze bonus yardage on the turns—stay "on course" with offset loads—keep positive load control, upgrade or down, with TD-24 Planet Power steering to eliminate "dead-track drag." Prove the cycle-speeding advantages of exclusive Hi-Lo shifting—for adjusting the speed to the load—for gaining capacity-adding reverse speed on shuttle dozing. Compare International's Cerametallic-faced engine clutch—for power-transfer efficiency—operating and servicing ease—long life! See your International Construction Equipment Distributor for a TD-24 demonstration!



International Construction Equipment

International Harvester Co., 180 N. Michigan Avenue, Chicago 1, Illinois

A COMPLETE POWER PACKAGE: Crawler and Wheel Tractors... Self-Propelled Scrapers... Crawler and Rubber-Tired Loaders... Off-Highway Haulers... Diesel and Carbureted Engines... Motor Trucks... Farm Tractors and Equipment.

**You don't have to
weld it...
you just point it!**



STOODY SEMI-AUTOMATIC HARD-FACING
The fast way to take the work out of welding!

Hard-facing with the new Strody Semi-Automatic Wires is *that* easy! You simply "aim" the wire and strike the arc. The semi-automatic machine does the rest... automatically feeds the wire at the correct rate, lays down a sound deposit—stringer bead or wash pass.

Man, it's a weldor's dream! No fluxes, no flux dams. Perfect visibility of the weld every inch of the way. And talk about speed—2 to 4 times faster than manual welding...ideal for covering big areas quickly, extremely handy for maintaining equipment between shifts! No changing of electrodes either...welding is continuous as long as there's wire on the reel and this naturally means an end to stub end waste.

With Semi-Automatic's low heat input and low penetration, there's less dilution of the deposit. *Less dilution* means *higher alloy content* with increased wear resistance, usually superior to manual electrodes of similar analysis. There's a complete line of wires with just the right analysis for every job!

TRY SEMI-AUTOMATIC HARD-FACING THIS EASY WAY—Your Strody dealer will arrange for a semi-automatic demonstration in your plant—on your own job. (Check the yellow pages of your phone book for nearest Strody Dealer.) Let him prove how Strody Semi-Automatic Hard-Facing can cut your maintenance costs!

STOODY COMPANY

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precipitates—NORTHWEST

Harvey Aluminum Set For Far East Deliveries

Harvey Aluminum Company has completed arrangements for the freighting of alumina from the Far East for the company's reduction plant at The Dalles, Oregon. Under the terms of the company's charter contract with a joint venture of three Canadian firms—North Pacific Shipping Co., Ltd., Anglo-Canadian Shipping Co., Ltd., and Western Canada Steamship Co., Ltd.—The Dalles, Oregon, on the Columbia River 190 miles inland from the sea, is established on a permanent basis as a regular seaport of call for bulk cargo carrying ocean-going vessels.

Harvey has chartered approximately thirteen cargoes a year for a period of five years. The Canadian carriers will load alumina alternately in the ports of Shimizu and Niihama, Japan, and will discharge the cargo at a Columbia River dock now under construction at the company's plant site just northwest of The Dalles, Oregon.

To facilitate this movement, Harvey Aluminum has designed and is constructing a large unique barge-mounted pneumatic unloading system which will suck the alumina from the ship's holds and pump it to shore-mounted storage silos. This installation is the first floating automatic unloading device of its kind anywhere in the world, according to company officials. It will provide the shipper with a rapid turn-around for their vessels, and can also be used to unload and transfer ores, grain, and other bulk cargoes. The unloading equipment will only be used part-time by Harvey and will be made available to other shippers for unloading, stowage, and transfer of bulk cargo on a rental basis.



The old *Red Bird* lead-silver mine near Clayton, Custer County, Idaho, once worked by *Ford Motor Company* for lead for batteries, has been purchased by the *Bunker Hill Company*. The 33-claim property was acquired from Louis Buchman, Lester S. Breckon, and J. A. Norden, Salt Lake City men who bought it from Ford in 1946 and subsequently produced more than \$500,000 worth of ore. Work by the new owner will depend upon metal prices. Under consideration, however, is exploration below the 900-foot level. Bunker Hill is the largest operator in northern Idaho's Coeur d'Alene mining region.

Geological drilling by *Pinnacle Exploration, Inc.* of New York City at property of *Uranium Mines, Inc.*, east of Mullan, Shoshone County, Idaho, accomplished objectives of locating the Snow-storm and Silver Cable vein structures at more than 500-foot depths. More work is planned next season. Pinnacle is a subsidiary of *Callahan Zinc-Lead Company* and *Vulcan Silver-Lead Corporation*.

Sunshine Mining Company has resumed stoping above the 3,200 level in adjoining ground of *Metropolitan Mines Corporation* and recent production has been around 600 tons a month. The

properties are in the Silver Belt of the Coeur d'Alene Mining Region, Shoshone County, Idaho.

Day Mines, Inc. has completed a 300-foot extension of a vertical winze at its *Hercules* lead-silver mine at Burke, Shoshone County, Idaho, for the purpose of opening a new 1900 level. At the firm's *Dayrock* mine north of Wallace, the new Bonanza vein now is regarded as a major contribution to the mine's ore reserves. However, production was curtailed because of the 13½-cents-a-pound lead price.

Production of silver-copper ore at the *Galena* mine west of Wallace, Shoshone County, Idaho, is providing a "very satisfactory" return to the lessees (*American Smelting and Refining Company* and *Day Mines, Inc.*). An inclined winze on the vein from the 3,400-foot level was approaching the 3,600-foot depth at last report. Ore grade and width compared favorably with those at higher levels.

Shaft deepening at the *Livingston* mine in the Boulder district of Custer County, Idaho, has reached the 2,750-foot depth objective, where a new working level is to be opened. *Hecla Mining Company* of Wallace is doing the work under an operating agreement with *Idaho Custer Silver-Lead Mines*.

Too many boulders and spotty gold sands caused Jack Fisher and Vic Griffith of Cascade to abandon efforts to recover gold from the Snake River at the mouth of Conner Creek, Washington County, Idaho. Equipment included a caterpillar, dragline, and washing plant. The area will be inundated by Idaho Power Company's Brownlee Dam reservoir. Conner Creek yielded considerable gold in early days.

A small crew carried on development and mining operations at the Kootenai

County, Idaho property of *Idaho Gold-fields, Inc.*, during 1957. Seven shipments of concentrates had been trucked to the *Bunker Hill* smelter at Kellogg at last report.



The *Trout Mining Division of American Machine & Metals Inc.* has taken a lease and purchase option on 1,372 acres adjoining its holdings at Philipsburg, Montana. The property has been inactive for many years but has a history as an important producer of silver; some manganese, lead, and zinc are also present. Trout holds about 200 acres in this vicinity, and is seeking additional area for growth. The firm's production totalled \$6,500,000 in the period from 1952 through 1956; this came from expanded manganese dioxide output and resumption of silver production.

Gold Reserve Mining Company, which recently acquired the *Ruby* claims near Zortman in Phillips County, Montana, plans to outline the ore bodies known to be existent on the property. If the exploration results are satisfactory, the firm plans to rehabilitate the cyanide mill on the property and to undertake mining and milling operations.

Northern Mining Company at Landusky, Montana is mining gold from its *Hawkeye* open-pit mine and milling it in the new 50-ton mill on the property. The mill is also treating custom ore from neighboring properties. Construction of the mill is quite unique in that it was carved into the rock hillside, and the



U.O. Ore Found on Western Uranium's Claims

Exploration by *Western Uranium Mines, Inc.* on Washington's Spokane Indian reservation has proved favorable according to recent reports which indicate primary type uranium mineralization has been found. Diamond drilling has indicated radioactive zones at depths of 67 feet, 120 to 130 feet, and at 170 feet. The hole was bottomed at 330 feet. Additional core drilling is scheduled. Pictured above is an aerial view of mining operations on the Spokane Reservation. The maze of roads, benches, cuts, and piles is the *Midnite* mine of *Dawn Mining Company*. In the center foreground are ore bins and ore stockpiles. Service buildings are shown in the left foreground. *Western Uranium* operations are shown in the upper right corner, and current drilling is near the point where a *Dawn* road makes an inverted "V."



Gardner-Denver DH-143



Gardner-Denver Rotary 600

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SUPER 5½" DH143 CRAWLER DRILLS—self-propelled heavy-duty drill. Packs plenty of deep hole punch in all formations.

DELUXE "AIR TRAC"® CRAWLER DRILLS—all controls for drilling, drill positioning and crawler drive are centralized for ease of operation. Available with 4" or 4½" drills. Also "Air Trac" without remote controls.

NEW GARDNER-DENVER "MOLE-DRIL"**—for use with rotary rig. An in-the-hole drill in two models for drilling 4¾" and 6" hole in hardest rock.

WAGON DRILLS—light- and heavy-duty for every need. AUGER DRILLS—both wagon drills and "Air Tracs" can be equipped with rotary motor for auger drilling.

QUARRY DRILLING AND BROACHING DRILLS.

DEEP HOLE DRILLS, DRIFTERS AND SINKERS—a complete line.

AIR FEED LEG DRILLS—and air feed legs for sinker mounting.

DRILL FEEDS AND CONTROLS—to fit every drilling job.

For Quality Drill Steel . . .

SECTIONAL DRILL RODS—highest quality—shot-peened and carburized to stand down-the-hole gaff longer.

RING SEAL SHANKS—replaces old-type water swivel without adding additional length to drill.

COUPLINGS—extra long threads—made for longer drilling life.

For Air Power . . .

GARDNER-DENVER ROTARY PORTABLE COMPRESSORS—five models that offer water-oil cooling for all-weather operation, "THRIFTMETER"® fuel control, easy-to-get-at parts for speeding maintenance, clutch that eliminates cold-weather dry compressor starting. Sizes from 125 cfm. to 900 cfm.

STATIONARY AND SKID-MOUNTED COMPRESSORS—eight compact WB compressor packages that deliver continuous trouble-free performance. Water-cooled. Combination radiator-intercooler saves cooling water. Sizes from 1150 cfm. to 142 cfm.

For Building Your Own Jumbo . . .

JUMBO COMPONENTS—for tractor and truck mounting or building your own jumbo.

DRILL POSITIONERS—provide hydraulic swing and dump on end of booms for drill and feed positioning.

HYDRAULIC BOOMS—powered by creep-free hydraulic cylinders that operate at low pressures.

HYDRAULIC REMOTE CONTROLS—for remote-control operation of drills, feeds, drill positioners and booms from any centralized position.

Plus . . .

Bit Grinders • Centrifugal Pumps • Air Hoists • Drill Steel Shapers • Sump Pumps • Air Maintenance Tools
Oil Forges • Air Line Oilers • Air Motors • Breakers
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NORTHWEST

only construction involved was putting a roof over the plant. The floor and sides of the mill building are the country rock.

The Young-Montana Corporation shipped a total of 26,288.15 long tons from its Willow Creek mine at Stanford, Montana during the 1957 season. Cleveland-Cliffs Iron Company and American Steel and Wire received the ore. Negotiations for 1,000 tons were carried on with Columbia-Geneva Steel Division of the United States Steel Corporation during the closing months of the season. The mine was opened by E. A. Young in 1956, under lease from Dewey and Norman Whittaker. Some new equipment has been installed for the 1958 season.

The Montana School of Mines, cooperatively with the Mineral Industries and the Montana Bureau of Mines and Geology, is offering opportunities for graduate study and research in geology, geological engineering, mining engineering, petroleum engineering, mineral dressing, mineral dressing engineering, metallurgy, and metallurgical engineering through graduate research fellowships, teaching and research assistantships. Information may be obtained from the chairman of the school's Graduate Faculty in Butte, Montana.

Clyde R. Boyle of Rapid City, South Dakota has been granted a 40-year lease in Beaverhead County, Montana by the State Land Board. The land is in section 16, T. 5S, R. 8W. about 12 miles north of Dillon. Terms call for Mr. Boyle to pay the state five percent royalty on all sale of manganese for 10 years. After that time the state may renegotiate, increasing the royalty if production warrants.

A Helena, Montana mining firm, Continental Columbium Corporation, has been organized by W. R. Price, H. M. Bangert, and Betty B. Condon. Authorized capital is \$250,000.

Montana Gold and Chemical Company at last report was using a small bucket-line dredge at a placer gold property near Gold Creek in Powell County, Montana.

Hi-Line Mines has been incorporated by Gordon M. Terpe, Dale Y. Anderson, Ralph E. Getter, and Wilbur P. Werner, all of Cut Bank, Montana, and Frances H. Sheppard of Shelby, with authorized capital of \$50,000.



Hanna Nickel Smelting Company at Riddle, Oregon recently increased the capacity of its ore preparation system by 33 percent by rebuilding the dutch ovens which supply heat to the ore dryers and increasing the speed of the conveyors. Reason for this was that the old ovens could no longer keep up with the increased demand from the melting furnaces. The increased output of the dryers has resulted in a supply 20 percent in excess of present furnace demand, and it is now possible to try experiments for upgrading the ore.

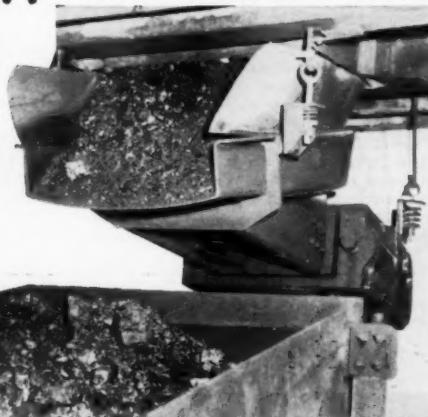
A substantial amount of mercury again is coming from the Bretz mine in Malheur County, Oregon's Opalite mining district, following a 10-year shutdown. Arentz-Comstock Mining Venture of Salt Lake City is mining ore from a new pit

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economically at controlled
rates with . . .**

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"Vibra-Flow"

VIBRATORY FEEDERS



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CAPACITY



CONTROL OF FEED



DRIVE



INSTALLATION



SYNTRON Vibratory Feeders will handle almost any bulk material — dry or damp — hot or cold — fine powders to huge chunks.

SYNTRON Vibratory Feeders are made in a series of models, with single and multi-magnet drives with maximum capacities from 25 tons to 3,000 tons per hour.

The feed rate of SYNTRON Vibratory Feeders is instantly adjustable, simply by turning a dial knob through a number of steps from their minimum to maximum capacities.

SYNTRON Vibratory Feeders use an electromagnetic drive — There are no gears, belts, pulleys or eccentrics. 3600 powerful vibrations per minute from 230 or 460 volts, 60 cycle, a-c.

SYNTRON Vibratory Feeders can be suspension mounted from overhead — or base mounted on a solid foundation. Their compact construction takes up minimum space.

Syntron can help you with problems involving . . .

Vibrators (bins, hoppers, chutes)

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(Silicon and Selenium)

a-c to d-c Selenium Rectifier Units

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NORTHWEST

200 feet from earlier workings and treating it in a flotation plant and furnace.

Oregon Metallurgical Corporation at Albany, Oregon has received a \$4,000,000 contract calling for delivery of zirconium metal ingots to **Westinghouse Electric Corporation** during the next 12 months. First delivery of 350,000 pounds was supplied at an average price of \$11.50 per pound. The ingots are being made from zirconium sponge supplied by **Wah Chang Corporation's** plant at Albany.

Great Lakes Carbon Company is mining a diatomaceous earth deposit 10 miles southeast of Fort Rock, Oregon. The site was purchased from Dick Shaub. **Babler Brothers Construction Company** of Redmond is doing the work under contract.

About 30,000 cubic yards of overburden have been removed by two Euclid 20-yard scrapers and a D-8 Caterpillar. A Hough loader and four truck-trailers are used for loading and hauling ore to the Great Lakes plant near Terrebonne where test processing will be carried out.

The old **Cynthia** chrome mine in Josephine County's Whiskey Peak area has been returned to production by **Thunderbird Mining Corporation** of Medford, Oregon. An access road has been built to the 5,000-foot-high property from which ore was brought out by pack animals in World Wars I and II. First shipments down the road averaged about 47 percent chromium oxide. The company was organized by Frank Grover, Nate Smith, and E. C. Brittsan.

A flagstone quarrying operation has been started southwest of Riddle on Cow Creek, Douglas County, Oregon, by Melvin W. Parker of Grants Pass.



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SAFETY YELLOW means just that . . . SAFETY! The yellow Nyprene material reflects light and is readily visible in darkness. It minimizes damage from punctures by machinery and equipment.

Then add these six other major benefits and you'll see why Bemis SAFETY YELLOW Nyprene FLEXIPIPE is your best ventilation value . . .

Bemis also manufactures durable, economical Jute-grade FLEXIPIPE. Both types (Jute-grade and Safety Yellow) are available with Bemis Rope Seam Suspension at no extra cost.

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A 100-ton lead-zinc flotation plant is being built in the Jim Creek district of Pend Oreille County, Washington by **Utahcan, Inc.** of Spokane. The mill building is being constructed from lumber cut at the site. Machinery was obtained from the former **Young America** mine concentrator near Bossburg, Stevens County. The property was acquired early in 1957 under lease and purchase agreement from George and Henry Rushmier, and the company subsequently opened 17 veins by bulldozer stripping. Open-pit mining operations are scheduled. Cline E. Tedrow is mining engineer and L. L. Lorang, president.

Radioactive zones have been found at depths of 67, 120 and 170 feet by **Western Uranium Mines, Inc.**, on ground adjoining the **Midnite** uranium mine of **Dawn Mining Company**. Cores showed some primary type ore. Encouraging surface showings also have been found by stripping ground to the northwest near the Spokane Indian Reservation boundary. Sam H. Richardson is consulting engineer; David M. Berry, field geologist; and Don A. Gillis, secretary.

Daybreak Uranium, Inc. has been making weekly 540-ton shipments of autunite ore, valued at about \$10,000 each, from its main open-pit operation in the Mount Spokane district. The ore is processed at **Dawn Mining Company's** new plant at Ford, Washington. At Daybreak's **Louley** mine in the Spokane Indian Reservation, underground development work now totals more than 400 feet.

A \$250,000, two-stage, diamond drilling program for uranium has been undertaken by **Spokane National Mines, Inc.** in the Spokane Indian Reservation of Stevens County, Washington. Work was started recently on holdings of **Dahl Uranium Mine, Inc.** and **Big Smoke Uranium, Inc.**, after their stockholders approved a merger into Spokane National. Drilling sites were selected by James Quigley, mining engineer and vice president of **Centennial Development Company**, Eureka, Utah. J. A. Beatty of Metalline Falls has the drilling contract. Cline E. Tedrow of Spokane, consulting mining engineer, is doing field geological work. George Allison of Casper, Wyoming, petroleum engineer, is president and general manager of **Spokane National Mines, Universal Mining Corporation, Far West Mines**, and **Monida Mines** also have agreed to merge into the new firm, which has opened offices in Spokane.

Development of the ninth and tenth levels of the **Gold Dollar** mine in the Republic District of Ferry County, Washington is yielding surprisingly rich gold-silver ore. The new levels will be much more productive than those above. The mine is owned by **Day Mines, Inc.**, lead-zinc-silver producer of Wallace, Idaho, and operated under lease by **Knob Hill Mines, Inc.**, from its adjoining workings. The Knob Hill long has been Washington's leading silver producer and a leading gold producer.

precipitates—SOUTHWEST

Rutile Mine Opened Near Richmond, Virginia

A new source of rutile and ilmenite has been developed in the United States with the recent opening of Metal & Thermit Corporation's mine and ore processing plant in Hanover County, near Richmond, Virginia. At the present time, the only other domestic sources of rutile are in Florida and South Carolina. By 1958 the Hanover plant is expected to supply 12 percent of this country's rutile supply, more than 70 percent of which is now imported from Australia.

The \$1,250,000 project is located on an 800-acre tract containing estimated ore reserves which will last for 10 to 20 years, depending upon demands. Rutile and ilmenite will be mined by open-pitting. The ore will be transported by conveyor belt line to the plant, where it will be crushed and concentrated by water, gravity, electro-static, and magnetic methods. Concentrate will be kiln-dried and bagged for shipment. The plant will have a capacity of 100 tons of ore an hour, and annual production of 5,000 tons of rutile annually is anticipated.



American Potash & Chemical Corporation will explore for manganese ore deposits in the area around Batesville, Arkansas. Mineral rights over the 100,000 acres are held by *U. S. Manganese Corporation*, *Arkansas Mining & Exploration Company*, *Miller-Lipp Corporation*, and *Miller-McGee Manganese Corporation*. *Lehman Brothers* made all of the arrangements for the investigation. If results are favorable, a new company will be formed, in which American Potash will hold 55 percent of the stock. Manganese dioxide is now produced by American Potash at its Henderson, Nevada plant.

The *Mackey-Humm Mining Company* which has operated fluorspar mines in Hardin County, Illinois for 20 years, has been sold to H. Evan Roberts of Los Angeles. Mr. Roberts also purchased a controlling interest in the *Hicks Creek Fluorspar Mining Company*, an operator in Pope and Hardin counties for 10 years. Mr. Roberts is a part owner of the nation's largest metallurgical-grade fluorspar mine, the *Crystal Mountain* mine in Darby, Montana, operated by *Cummins-Roberts*. Associated with Mr. Roberts in the new venture is Clyde Flynn, Jr., general counsel for the *Independent Domestic Fluorspar Producers Association*, and an officer in the Hick Creek firm. Plans of the new company call for expansion of the flotation mill and greatly increased production of acid-grade fluorspar.

Eagle-Picher Company has resumed operations at 10 of its mines in the Tri-State district after a four-month suspension. To be reopened are the *Big Chief*, *Bilharz*, *Blue Goose*, *Gordon*, *Grace B.*, *Grace Walker*, *John Beaver*, *Lucky Jew*, *Netta*, and *West Side* mines. The Central mill at Commerce, Oklahoma also will resume operations. Work at all these operations will be on a one-shift basis, five days a week. The action

was taken in the belief that the federal government will provide some tariff relief for the current low market situation.

The *University of Minnesota*, through its Center for Continuation Study, will hold the 19th annual mining symposium at the Norshore Theater in Duluth, January 14 and 15. As in previous years, the symposium is held in conjunction with the mining section of the AIME. Included on the program are such subjects as: handling of intermediate ores (scrubbing and screening, particularly); design and operation of surge pits and surge bins; stockpiles and handling of concentrates; design and preparation on tailings ponds; and subjects dealing with open-pit operations.

The *Interstate Commerce Commission* has authorized the *Missouri Pacific Railroad* to build a 24-mile branch in Washington County, Missouri to serve the *Meramec Mining Company* operations at Pea Ridge. The branch will run from Mineral Point-Potosi through Latty and Troutt to the Pea Ridge area. Meramec was formed by *St. Joseph Lead Company* and *Bethlehem Steel Corporation* to mine this property which is estimated to contain about 100,000,000 tons of iron ore.

Republic Steel Corporation at Birmingham, Alabama has notified iron ore mine operators in the West Plains, Missouri area to discontinue shipments. The director of the Missouri Division of Resources and Development has commented that this is normal in the iron and steel industry and that ore producers must expect such period. He reports that his agency is reviving a plan to obtain a million dollar blast furnace for Missouri to process ore now mined in the Ozarks, and for the deep rich ore that will be mined in the Bourbon, Missouri area when the shafts are completed there.

Ottalla Industries says it has completed a portable uranium mill at Breck-

enridge, Minnesota which it plans to lease or sell to small operators. Equipment includes a crusher, grinder, leaching system, and separator. It will use the ion exchange resin column to obtain U_3O_8 and also the solvent extraction method, according to the inventors.



American Smelting & Refining Company's long-range search for new minerals and metals has resulted in the discovery of titanium-bearing sands near Lakehurst, New Jersey. The company has leased thousands of acres in an area located between Lakehurst and the Atlantic Ocean. The property is partly swamp land. Exploration teams have also been looking in Florida and at Cumberland Island, Georgia.

East Tennessee, fast becoming the largest zinc producing district in the United States, may be even bigger soon. Robert A. Laurence, regional geologist for the United States Geological Survey, reports that \$3,000,000 is currently being spent on zinc exploration in Tennessee. Half of this amount is being advanced by the government through the Defense Minerals Exploration Administration loans; the additional \$1,500,000 is from the various mining and exploration companies active in the district.

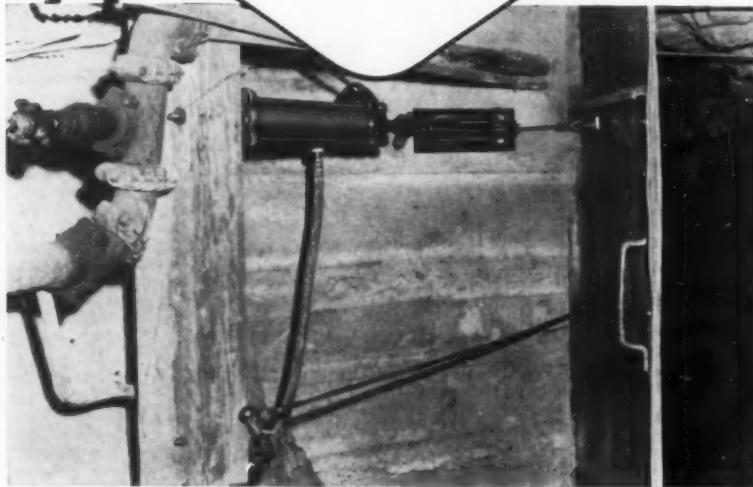
A uranium deposit is reported to have been located by two prospectors in Juanita township of Pennsylvania. G. W. Stephens and D. F. Brown indicate that it is a channel type containing a copper-uranium ranging in grade from 0.06 to



New Kaiser Alumina Plant To Begin Production

Shipments of bauxite ore are now being received at Kaiser Aluminum & Chemical Corporation's new \$70,000,000 alumina plant under construction on the Mississippi River at Gramercy, Louisiana. The plant, which will also produce caustic soda and industrial chlorine, will soon begin operations. Pictured above is the "Marine Merchant," operated by the Marine Transport Lines, delivering a 11,600-ton shipment of ore from the company's mines in Jamaica. The ore is unloaded by mechanical unloaders and transported along covered conveyor lines to the aluminum-covered storage building shown in the foreground. Mud settlers, digesters, and precipitators are shown in the background. Kaiser Aluminum recently opened a pilot plant at Nichols, Florida, to recover fluorine from phosphate wastes for use in aluminum manufacture. (See MINING WORLD, May 1957, page 89).

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1"	360	570	810	1,350	2,400	4,800	7,200	10,800	14,400	21,600	25,200
1 1/2"	900	1,350	1,890	3,150	5,400	10,800	16,200	24,300	32,400	48,600	54,000
2"	2,700	3,600	5,400	9,000	16,200	32,400	48,600	72,900	97,200	145,800	162,000
3"	6,400	8,100	12,150	21,300	36,000	72,000	108,000	162,000	216,000	324,000	360,000
4"	16,200	21,600	32,400	54,000	97,200	194,400	291,600	437,400	582,000	873,600	936,000
5"	40,000	54,000	81,000	135,000	240,000	480,000	720,000	1,080,000	1,440,000	2,160,000	2,520,000
6"	100,000	135,000	210,000	315,000	540,000	1,080,000	1,620,000	2,430,000	3,240,000	4,860,000	5,400,000
8"	250,000	324,000	486,000	729,000	1,440,000	2,880,000	4,320,000	6,480,000	8,640,000	12,960,000	14,400,000
10"	625,000	810,000	1,215,000	1,825,000	3,600,000	7,200,000	10,800,000	16,200,000	21,600,000	32,400,000	36,000,000

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0.33 percent U_3O_8 . Mineralization is in the Catskill and Chemung formations.

Crucible Steel Company of America has acquired full ownership of **Rem-Cru Titanium, Inc.**, which had been owned jointly by Crucible and **Remington Arms Company**. Rem-Cru has a plant at Midland, Pennsylvania, adjacent to Crucible's Midland steel plant.

The 1958 meetings of the **American Congress on Surveying and Mapping** and the **American Society of Photogrammetry** will be held at the Shoreham Hotel in Washington, D. C., March 23 through 29. A co-exhibit is held in conjunction with the meeting.

Haile Mines Inc. has decided to sell the **Tennessee Manganese Division** property because the immediate profit outlook does not warrant the heavy additional development expenditures necessary to bring about a satisfactory return on the investment. The entire tungsten industry suffered a set-back because of the interrupted domestic buying program. Haile's subsidiary, **Tungsten Mining Corporation**, also was affected. In the fiscal year ended August 31, 1957, 147,010 units were produced. In early July the underground mining was cut to a four-day week, with the mill operating on five, in order to balance production with sales to industry. Tungsten Mining has also made substantial reductions in the cost of production, and further reductions are being made.

Two recent reductions in metal prices have been announced. **American Smelting & Refining Company** has cut the price of selenium from \$10.50 to \$7.50 per pound for common grade. The high purity grade has been reduced from \$13.50 to \$10.50, and ferro-selenium has been reduced from \$11.20 to \$8.00 per pound. **Carborundum Company** has cut the price of reactor grade zirconium sponge by \$5.00 per pound. The new price is \$7.50 per pound.

International Minerals & Chemical Corporation has a five-year contract to supply **Kaiser Aluminum & Chemical Corporation** with more than 10,000 tons of fluorine compound annually. Fluorine, in the form of fluosilicic acid, will be reclaimed by IMC from the processing of phosphate chemicals at its Bonnie, Florida plant, and used by Kaiser at its new Mulberry plant in the first stage of producing synthetic cryolite.

Salem-Brosius, Inc. and **Diamond Alkali Company** are undertaking a joint research and development program on a new experimental furnace for continuous tonnage chlorination of refractory ores. The furnace is a high temperature electrical resistance, horizontal tubular unit designed by the Salem-Brosius subsidiary, **Metal Chlorides Corporation**. The program will include treatment of a wide variety of materials in the furnace, including titanium, zirconium, chromium, boron, chrome ores, coke breeze, columbite, molybdenum oxide, ilmenite, uranium, "yellow cake" and titanium-bearing red mud from the Bayer alumina process.

An additional \$4,800,000 has been certified by the Office of Defense Mobilization to finance exploration aid during fiscal 1958 under the DMEA program. This brings to \$38,800,000 the total amount of funds authorized for this program. Certain commodities have been changed from 75 percent government

CENTRAL AND EASTERN

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participation to 50 percent. (This is a reduction in the government's portion of allowable costs.) These are: asbestos (chrysotile) columbium, corundum, diamonds (industrial), kyanite (strategic), mercury, monazite and rare earths, platinum group metals, quartz crystals (piezoelectric), tantalum, thorium, tin tungsten, and uranium. Other commodities which are eligible for 50 percent government participation are bauxite, cadmium, chromium, copper, fluorspar, graphite (crucible flake), lead, molybdenum, and zinc. The only commodities remaining eligible for 75 percent government participation are antimony, beryl, cobalt, manganese, mica (strategic), nickel, rutile-brookite, selenium, and talc (block steatite).

A discovery of uranium ore is reported from Columbus, Ohio. Laurence W. Huntington of nearby Groveport says he has discovered a large vein from five to 20 miles wide bordering Lake Erie in the northeastern part of the state. He also says he has worked out a method for processing the ore cheaply.

Republic Steel Corporation has closed its Fisher Hill iron ore mine for "economic reasons." Two other mines operated by Republic in Essex County, New York were not affected. At Gadsden, Alabama the company has completed installation of a new electric furnace and is completing a second. Most of the new facilities are for hot and cold rolled sheet and strip. In Cleveland, Republic has two new open hearth steelmaking furnaces in operation. A huge new slabbing mill has already rolled test ingots and will soon be in full production.

A citizens committee of 12 members is reviewing present stockpiling policies of the Office of Defense Mobilization and will make recommendations to the director. The committee will examine new concepts of stockpiling in the nuclear age, including the accumulation of a number of new strategic items such as medical supplies, food, and new metals connected with nuclear and missile weapons.

American Zinc Company of Tennessee, a subsidiary of American Zinc, Lead and Smelting Company, has greatly curtailed its DMEA exploration program at Strawberry Plains, Jefferson County, Tennessee. The current low market price for zinc, rather than results obtained from the exploration work, appears to be the reason for the reduction.

A new booklet available from the Maine State Geologist in Augusta for 35¢ outlines the public land mining law enacted by the legislature this year. With the aid of diagrams, the booklet describes the procedure for prospecting and locating mining claims on state-owned land. Since the organization of the Maine Mining Bureau in 1955, more than 80 claims have been staked on state lands for such minerals as diatomaceous earth, metal sulphides, and lithium. Diamond drilling has been undertaken on three of the staked areas, the best known of which is the Dow Chemical Company's exploration for lithium in Warren and Cushing.

Alan Wood Steel Company plans to build a plant to produce iron powder adjacent to its open hearth facilities at Ivie Rock, Pennsylvania. Part of the project includes an ore concentration plant to be located at the Scrub Oak mine at Dover, New Jersey. The ore will be processed at the mine and sent to the powder

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Wellman Engineering Company, a subsidiary of McDowell Company Inc., has been awarded the contract for a new ore bridge for Inland Steel Company's Indiana Harbor Works. The new bridge is a duplicate of Inland's No. 9 bridge which went into operation earlier this year. When installed, it will increase Inland's ore handling capacity to the level required by a new ore screening and sintering plant which is under design by Dwight-Lloyd Division of McDowell. The new sintering plant will be installed on a 20-acre site, and completion is scheduled for early 1959. The Wellman fabricated sintering machine, designed to produce an initial capacity of 4,000 tons per day of sinter product, and engineered to handle up to 6,000 tons a day, will supply Inland's blast furnaces with a beneficiated burden.

The Pittsburgh Steamship Division of United States Steel Corporation plans to build 12 new ore carriers at a cost of \$100,000,000, with the first new boat in operation by 1960. Each new vessel would be capable of carrying 25,000 tons of iron ore, more than any presently operating on the Great Lakes. The new ships would permit the retiring of 29 of the older vessels, which are smaller and more costly to operate. The Pittsburgh fleet carried about 21,700,000 tons this season, compared with 17,300,000 in 1956.

The final shipment of iron ore for the 1957 season via the Great Lakes left the Allouez docks of the Great Northern Railway on December 3. The "George M. Humphrey" of the Buckeye Steamship Lines, which carried this last load, set a new tonnage record for down-bound iron ore to lower lake ports during the year. The D.M.I.R. dock at Duluth loaded its final cargo on November 11, and the D.M.I.R. docks at Two Harbors loaded last cargo on November 23. These dates compare with December closings in 1956. Indications are that the season's total will be around 85,000,000 tons, or about 7,000,000 tons more than last year when strikes cut the season's total to around 77,000,000 tons.

Oliver Iron Mining Division of U. S. Steel Corporation estimates that shipments by Oliver this past season totaled about 34,500,000 tons of iron ore and concentrate, which will exceed 1956 by 4,000,000 tons. High-grade iron ore concentrates produced from low-grade ores and taconite accounted for approximately 6,900,000 tons of Oliver's shipments. Oliver's stripping program is getting under way; it will be one of the largest in recent years. Two plants will be completed this winter for the improvement of Mesabi ores next year. In its Canisteo District, on the Western Mesabi, Oliver has under construction a new heavy media unit at its Trout Lake concentrator in Coleraine. It is also planning for a new spiral concentrating unit at its Arcurus plant at Marble, which will recover 125,000 to 165,000 tons annually of fine ore product that would otherwise be discarded as waste.

precipitates—ROCKY MOUNTAIN

Reorganize AEC Office In Grand Junction, Colo.

Effective January 1, the Grand Junction Operations office of the United States Atomic Energy Commission at Grand Junction, Colorado has been reorganized. Primarily affected are those units responsible for programs for the evaluation of source material resources, uranium ore procurement, mining incentives, and the acquisition and production of uranium concentrates.

Two new units have been established—a Production Evaluation Division and a Source Materials Procurement Division—to replace three present operating and technical divisions: the Mining, Exploration, and Concentrate Procurement Divisions.

The Production Evaluation Division will direct the leasing and mining incentive and resource evaluation programs of the present Mining Division and the activities now carried out by the Exploration Division and the Denver and Salt Lake Area Offices which will become branch offices of the division.

To better serve the large uranium producing areas, particularly in Wyoming, New Mexico, Utah, and Colorado, there will be two additional branch offices at Casper, Wyoming, and Grants, New Mexico, and a Colorado Plateau Branch located in Grand Junction. The branches will carry out the field activities involved in the collection of ore reserve and ore production information, the appraisal of uranium resources, and related geologic activities.

The new Source Materials Procurement Division will assume the ore purchase and sales functions presently assigned to the Mining Division, in addition to continuing the concentrate procurement and production functions of the Concentrate Procurement Division.

applies principally to the manufacture and distribution of the Humphreys spiral concentrator.

Pinnacle Exploration, Inc. is working on a two-shift basis at its uranium prospect in the Marshall Pass area of Gunnison County, Colorado. Both underground exploration and a drilling program are being carried out.

In order to make more molybdenum available for future industrial growth, *Climax Molybdenum Company*, operating at Climax, Colorado, has arranged with the federal government for cancellation of its sole remaining contract to supply molybdenum to the government. The company has continued to retain its production of tungsten concentrate pending stabilization of the depressed conditions in the market. No sales have been made of that product since the government purchase program was terminated in 1956. At the government's request, *Climax Uranium Company* has deferred rights to sell its production of vanadium oxide to the AEC although sale of such oxide before the year-end is guaranteed by contract.

The U.S. Atomic Energy Commission will close the pilot plant in Grand Junction, Colorado, operated for it by the *National Lead Company*, on June 30, 1958. Work now done at the plant will actually be completed in February or March and the remaining time will be used to place it on a stand-by basis. After June 30, ore testing will be done by the Salt Lake City office. Members of the U.S. Geological Survey crew at Grand Junction are being transferred to other offices, and the AEC will take over this office space. The USGS had been doing exploration work for the AEC but more and more of this is being done by private groups now.

The drilling program on the U.S. *Manganese Corporation*'s claims near Silverton, Colorado has been completed for the season. A total of six holes were sunk to 250-foot depths, spaced roughly at 400-foot intervals. No reports of the results have been received. Purpose of the drilling was to obtain a better idea of the extent of the rhodonite deposits in this district. A pilot plant of *Vitro Laboratories Division* of *Vitro Corporation of America* now operating in West Orange, New Jersey is testing the commercial recovery of the ore by an electrode process. It is expected that a more extensive drilling program will be resumed in the spring.

The U.S. Bureau of Mines has conducted analyses of drill cuttings obtained from the oil-shale deposits in the north-central portion of the Piceance Creek Basin in Rio Blanco County, Colorado, and reports that these formations may have a higher potential oil content and a greater bed thickness than previously believed.

New equipment has been installed at the *Monarch* quarry of *Colorado Fuel & Iron Corporation* at Monarch, Colorado. A new hopper, feeder, and vibrating sizer have been added to increase performance, along with much improved conveyor belt system.

The lead-zinc operations of the *Rico Argentine Mining Company* at Rico, Colorado have been suspended because of the continued decline in base metal prices. The pyrite upgrading flotation plant treating stockpiled tailings from previous lead-zinc flotation and the 200-ton-per-day contact sulphuric acid plant continue to operate. As the supply of pyritic tailing decreases, it will be necessary to undertake underground mining of pyrite. Acid is sold to Plateau uranium mills.

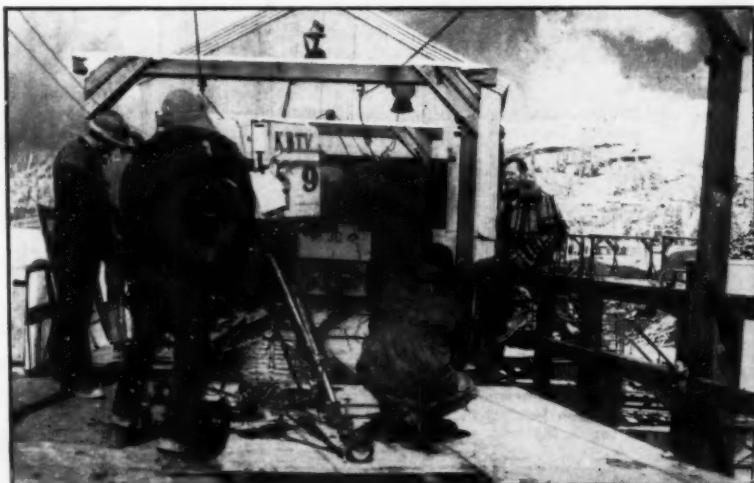


Standard Uranium Corporation has leased about 60 additional lead-silver-zinc properties on a long-term basis in the San Juan area of Colorado. The firm is currently developing lead-silver-zinc ore in the Crested Butte area of Colorado and is constructing a 250- to 300-ton mill to treat ore from this property.

Prospectors who staked five claims in an area northwest of Central City in Gilpin County, Colorado, report they have located a uranium deposit. A tunnel driven 500 feet cut seven shoots of autunite ore and was headed toward a pitchblende outcrop. Several uranium companies are said to be interested in the property.

Leadville Lead & Uranium Corporation is exploring property in the vicinity of its old *Hilltop* and *Last Chance* mines near Leadville, Colorado.

The *Humphreys Investment Company* has transferred all of the property and equipment applicable to its Engineering Division, along with certain other property, to *Humphreys Engineering Company*. The latter has been formed to carry on the business previously conducted by the Engineering Division. This



"Wide, Wide World" Features Climax Operations

Climax Molybdenum Company was "on the air" to approximately 33,000,000 television viewers recently, when the "Wide, Wide World" show was broadcast from Climax's operations at Climax, Colorado. Pictured above is John Petty, Climax assistant general superintendent, surrounded by T.V. cameramen as he prepares for an interview with Dave Garroway, *Wide, Wide World* master of ceremonies. Mr. Petty appears on the Phillipine level trestle with Bartlett Mountain in the background. The two-hour program included an interview with Dr. Walter Orr Roberts, head of the *Astro-Physics Department* of the *University of Colorado*, as well as Climax personnel and operations.

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Radorock Resources, Inc. decided not to join with several other uranium companies in a merger with **Hidden Splendor Mining Company**. Recent increases in the ore reserves at Radorock's *Radon* mine from 225,000 tons to more than 500,000 tons of high-grade uranium ore made terms of the original merger proposal unworkable, according to company officials. Radorock's property is located in the Big Indian district of San Juan County, Utah. **Federal Uranium Corporation** holds 52 percent of the stock.

Newmont Exploration Ltd., subsidiary of **Newmont Mining Corporation**, and **Security Uranium and Oil Company Inc.**, of Blanding, Utah have signed a joint venture agreement. The contract calls for a minimum of 10,000 feet of exploratory drilling of the 32-claim *It* group, and the mining of the property if ore is discovered. The claims are located in the immediate vicinity of the *Royal* and *Moki* mines in Indian Creek. Production is expected in the Mossback formation at the Moenkopi contact.

The **Atlas Corporation's** subsidiary, **Petro-Atlas**, has taken an option on potential leases covering 18,000 acres of oil shale land in Uintah County, Utah, east of Vernal. The arrangement is contingent upon Rod Dixon and John H. Morgan, Jr., obtaining approval for the leases from the **Utah State Land Board**. They, in turn, will grant the leases to Petro-Atlas. An exploration and development program would then be undertaken.

The prime contractor for erection of the 800-ton uranium mill near Mexican Hat, Utah is completing "qualification" operations. **Stearns-Roger Manufacturing Company** is now about ready to turn the operation over to the owner, **Texas-Zinc Minerals Corporation**. This huge project had necessitated creation of a whole new town near the Utah-Arizona border; creation of a new road system from the White Canyon mining district to connect with Utah State Highway No. 47 near Bluff; and conversion of the *Happy Jack* mine in White Canyon to an open-pit operation.

A new Bucyrus-Erie 190-B shovel with an 8-yard dipper is being used to make a drop-cut to the 5640 level of **Kennecott Copper Corporation's** Bingham pit in Utah. This is the first time the mine has used a shovel of this large capacity. The shovel started operations from an elevation of 5690. It is proceeding to dig down on a three percent grade until it has reached an elevation of 5678, 12 feet lower than the starting point. At that point a sump is dug and a semi-permanent electric pump installed to handle the water. The shovel then will level off and proceed to cut a 12-foot deep channel, raising on a water grade of 0.25 percent within the entire circle formed by Track A. After the shovel has completed the first cut, Track A and the electrification towers are lined to new positions, known as Track B. This continues until, at the completion of the fifth cut, the new 5640 level will be established.

The **U.S. Atomic Energy Commission** has granted shipping permits for radio-

active materials to the following Utah operators: Joseph L. Barber, who plans production of 1000 tons of 0.40 percent ore from 22 *Hidden Rainbow* claims in Sinbad Desert, Emery County; Dean Shumway, who plans production of 500 tons of 0.30 percent ore from *Blue* group in Monticello mining district San Juan County; **North Range Mining Company**, which plans production of 30,000 tons of 0.25 percent ore from 35 claims (including *Sandy No. 2* mine) in White Canyon district, San Juan County; **Western Minerals Company**, which plans production from *Red 0*, *Red 00*, and *Moonshine* claims in San Juan County.

The **U.S. Bureau of Mines** has released a report covering mining methods and

costs at the *La Sal* uranium mine in San Juan County, Utah. This is one in a series describing representative mining operations in various parts of the U.S. The report covers exploration, development—including methods and costs of sinking a 572-foot, three-compartment shaft, haulage ventilation, auxiliary operations, and safety practices, comparing them with methods at other mines in the Big Indian district. A copy of Information Circular 7803, "Mining Methods and Costs—*La Sal* Mining & Development Company" can be obtained from the Bureau of Mines' Publications-Distribution Section at 4800 Forbes St., Pittsburgh 13, Pennsylvania.

Utah Beryllium Inc. has been mining and stockpiling beryl at its properties in

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ROCKY MOUNTAIN

the Sheeprock Mountains of western Utah. A mill will be installed early next year to process the ore. The corporation also plans to expand its production next year because of the growing importance of the mineral in research and development programs. The company is owned jointly by Gayle Sherry Leslie of Los Angeles, and *RanRex Oil & Mining Company, Inc.* of Bountiful, Utah.



Davison Chemical Company, a division of W. R. Grace Company, has postponed indefinitely its plans for building a 200-ton-per-day sulphuric acid plant in Wyoming. A week earlier, *Platte Chemical Company* of Salt Lake City had announced it bought land east of Casper, Wyoming for erection of a \$2,500,000 sulphuric acid plant. Davison had an option on property nearby. Both will probably wait for a clarification of the uranium milling situation in the Gas Hills-Crooks Gap districts in order to know exactly how much sulphuric acid would be required by these mills.

Preliminary drilling on the optioned property of *Western Nuclear Corporation* in the southwestern Gas Hills of Fremont County, Wyoming has been quite favorable and it is considered likely that the firm will exercise its option to purchase the claims. Known as the *Loma 3-12*, the group is located in the northern half of Sec. 24, T. 32 N., R. 91 W., about four miles southwest of *Western Nuclear's Bull Rush* mine. The company paid \$10,000 for a one-year option on the *Loma* claims, and spent about \$13,800 on drilling. An additional \$30,000 is required upon exercise of option, along with a five percent royalty on future gross production.

Mining operations have started at the 1-A open pit of *Lucky Mc Uranium Corporation* in the central Gash Hills area of Fremont County, Wyoming. Stripping operations had been underway for some months. Stripping has also been completed in the 4-A pit and mining should start there soon.

It is rumored that *Kerr-McGee Oil Industries* has purchased additional claims in the Shirley Basin of Carbon County, Wyoming. The claims are said to total about six sections and to be located to the south of property owned by *Teton Exploration Company* and optioned to *Utah Mining*.

The U.S. Atomic Energy Commission has granted shipping permits for radioactive materials to the following Wyoming operators: Charles Kelley and Dougles Twiford, who plan production from 17 *Columbus* claims and eight *Pilgrim* claims in Johnson and Campbell counties; LeRoy Johnson and Berton Walker, who plan production from five *Nevada* claims in Niobrara County; *Redland Mining & Exploration Company*, which plans production of 300 tons of 0.20 percent ore from properties in Fremont County; and *Jerrett Enterprises*, which plans production from four *Grady* claims, two *Lucky* claims, and 10 *Sandy* claims, all in Converse County.

precipitates—SOUTHWEST



A four-chamber electrostatic precipitator is being installed in the new smelter being constructed at Hayden, Arizona by the *Ray Mines Division, Kennecott Copper Company*. It will be used to clean gases generated by the reverberatory furnace and copper converter. The unit, which has a capacity of 300,000 cubic feet of gas per minute, was designed and fabricated by the Metal Products Division of *Koppers Company, Inc.*, Baltimore, Maryland.

Radio Chemical Corporation of Los Angeles, California has offered to construct a 50-ton-per-day uranium mill in the Globe, Arizona area. The report was made by Leigh Woolson, an engineer for the firm, at a meeting of the *Arizona Uranium Ore Producers Association* in Globe. Mr. Woolson said his company has a mill in operation at Mojave, California, and is licensed by the AEC to erect three more mills. He said his firm's process works and that the break-even point was 0.15 ore. Last June the AEC closed its ore buying station at Globe because ore grade was too low, was too difficult to mill, and ore reserves were small. Observers said Gila County uranium ore was higher than 0.15, the break-even point for the proposed mill. Under terms of Mr. Woolson's proposal, 40 percent of the operation would eventually be owned by Arizona interests. No definite action was taken by association members on the proposal, officers of the association apparently wanting additional time to investigate.

Phillips Petroleum Company is sinking a 210-foot shaft on leased property in the Navajo Indian reservation, Navajo County, Arizona. The company obtained the lease in a sealed bid sale conducted by the reservation officials in January 1956. The uranium ore is expected to average about 0.50 percent U_3O_8 . The new *Texas-Zinc Minerals* plant at Mexican Hat, Utah will treat the ore.

The *Bureau of Land Management* expects to complete a cadastral survey of 106 sections in Arizona before the end of 1957. The sections are in previously unsurveyed townships and represent the state's portions of each. Survey parties directed by E. H. Kimmell, cadastral engineer for the BLM, began the project more than a year ago.

At the *Ray Mines Division of Kennecott Copper Corporation* at Ray, Arizona, a committee of superintendents and department heads has been appointed to develop a cost reduction program. This program will include inventory reduction, reduced use of forms, paper and reports, preventive maintenance and maintenance control, absentee control, lubrication control, force control, supply and materials control, etc. Employees can play a big role in cost reduction and employment security, says the company, through the Suggestion System Award Program which is aimed at cutting costs and putting practical suggestions into immediate effect.

The *Union Gypsum Company* is shipping from 250 to 300 tons per day of cleaned crushed gypsum to its plant in

Phoenix, Arizona, where the product is used for making lathe and wall board. Completion of a new screening and crushing plant is expected to increase productive capacity to 500 to 600 tons daily. The company's gypsum deposit is located 11 miles south of Winkelman and one mile east of the Winkelman-San Manuel highway. Mining is done with a 1½-yard Northwest shovel, loading into two Reo trucks which, in turn, deliver the mine-run materials to a screening plant a mile distant. The mine run is screened in shaking trommel screens and the fines discarded. The cleaned gypsum is crushed to about ½-inch to 1-inch sizes, then hauled by truck to Winkelman for rail shipment to Phoenix. The shipping product is said to average about 90 percent $CaSO_4$. Leo Hicks is plant superintendent. Archie Lee of Mammoth is mine superintendent.

The low prices for lead and zinc have forced the shutdown of the *Athletic Mining Company's* mining and milling operations in the Aravaipa district at Klondyke, Arizona. Immediately prior to the shutdown, all broken ore in the mine was milled and a small amount of exploration work completed. One caretaker remains at the mine as watchman. Harvey L. Horton of Safford, is general manager.

The *Hart and Daniel* manganese claims, between Quartzsite and Ehrenburg, Arizona, are being worked by two different groups. The northern portion is operated by Jesus Daniel, and the southern section by J. Speake under lease from Daniel. The property consists of about 12 patented claims and several unpatented claims extending over a mile in length and three or four claims wide. Daniel is working four to six men, and Pete Appelman (who is in charge for J. Speake) employs 10 to 12 men. At both operations wide bulldozer cuts have been made and short shafts sunk. Considerable stripping of conglomerate is necessary to clear the ore in the pits. Equipment includes an RD-8 Cat, slushers and two 350 compressors. Appelman at present is shaft sinking and is down 40 feet. A second shaft, 300 feet to the northeast, is being sunk for ventilation and access purposes. Both operators stockpile ore for a while, then truck (by contract) the ore to Ehrenburg. The better grade of ore runs from 48 to 52 percent MnO_3 , while the low-grade runs 9 to 24 percent MnO_2 . Daniel ships about two carloads of high-grade to Ehrenburg a week. A considerable tonnage of low-grade has been accumulated.

Exploration work at the *Sein Fein* mine, Klondyke, Arizona, is being continued by the *Cordillera Mining Company* of Grand Junction, Colorado. Jim Martin, manager. During the summer months the main shaft was sunk an additional 50 feet, to the 650-foot level, and a program of drifting on the eighth, or 600-foot level, was undertaken. Currently, six men are employed under the direction of Elton Kidd, mine manager, Klondyke.



A full-scale exploration program for saline deposits in the Mojave Desert of

California reportedly is to be undertaken by *Kerr-McGee Oil Industries Inc.* The firm has leased more than 14,000 acres from the *Southern Pacific Land Company* for a 25-year period, and must drill the first hole by June 1, 1960. Much of the land is near Boron, California, where *United States Borax & Chemical Corporation* has recently opened its \$2,000,000 open-pit operation. Kerr-McGee has the rights to all saline minerals, including sodium, potassium, boron, and lithium.

Macco Corporation has slowed down output at its mill near Rosamond, California from a 24-hour, seven-day week operation to an 8-hour, 5-day week. The warehouse system is also being scattered to various points in the state. Reason for this is a lessening in demand for barite by the oil industry. The company's mine at Nine-Mile Canyon will be reopened in the spring, however.

The *State of California Division of Industrial Safety* has set the time and place for public hearings for the purpose of considering revisions of the Mine Safety Orders. These orders are of general application throughout the state, relative to reasonable safety standard and safety devices. In San Francisco, the hearing will be held on February 19, 1958 at 10:00 a.m. in Room 409, 965 Mission Street. In Los Angeles, the meeting will be held on March 5 at 10:00 a.m. in the Assembly Room of the State Building.

Since the inception of the Defense Minerals Exploration Administration, 61 contracts have been executed in California. To the end of October 1957, 17 of these were in force, and a total of 19 discoveries had been certified by the DMEA. Among the discovery certifications were these: *Obelisk Mining Company*, tungsten in Fresno County; *Owl Springs Company*, manganese in San Bernardino County; *Helmke, Thomas & Janssen*, chromium in Butte County; *Climax Molybdenum Company*, lead-zinc in Madera County; and *Coso Uranium, Inc.*, uranium in Inyo County.



Kaiser Engineers have started clearance of the site for *Eagle-Picher Company's* new diatomaceous earth plant near Lovelock, Nevada. Actual construction should get underway shortly.

U.S. Gypsum Company has been stockpiling perlite at its mill in Kodak, Nevada, four miles east of Lovelock. The ore comes from an open-pit operation in the Trinity Range seven miles from Lovelock. John Pedro has the mining and trucking contract. At the mill, the ore is crushed and sent through the cleaning and classifying plant. Then it is either stored in bins or loaded directly into boxcars on the railroad siding.

A deposit of uranium ore is reported to have been found by *Thomas White and Associates* of Mountain City, Nevada. Preparations are being made to ship the ore to *U.S. Gypsum Company's* mill in Salt Lake City, Utah.

Bristol Silver Mines Company reports that an extension of the Bristol silver ore body has been discovered on the 1,050-foot level in its mine in the Pioche

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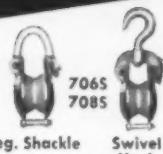
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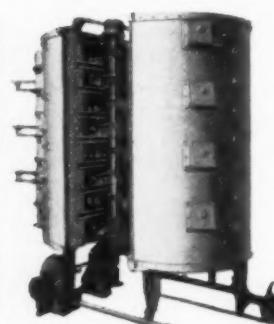
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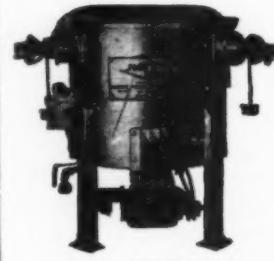
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district of Nevada. The ore body has been mined on the 500-foot level and it is now assumed that this is a downward extension from the 500 to the 1,050 and possibly through the 1,700 level, lowest working level of the property. Shipping has started from the newly located ore body.

Manganese Inc. operated at full rated capacity in 1957 at its property near Henderson, Nevada. 5,169,827 long ton units of metallurgical grade manganese nodules were produced, with a gross revenue of \$7,402,728. About the same revenue was made during the 1956 fiscal year but the company showed a loss because of the considerable expenditures necessary for stripping the overburden from the *Hydro* pit ore body. The completion of this program, coupled with certain metallurgical efficiencies and the installation of new conditioning equipment, contributed to a successful year.

Titanium Metals Corporation has made its third work force reduction in a year at its operations near Henderson, Nevada. A cutback by aircraft companies because of the cancellation of government contracts is blamed for the situation. Aircraft companies use most of the titanium produced.

Kaiser Aluminum & Chemical Corporation has closed its fluor spar mill near Fallon, Nevada, and placed the facilities on a standby basis for an indefinite period. The mill, which was erected in 1952, produced an acid grade of fluor spar concentrate from ore mined by the company near Gabbs, Nevada. The mine was closed earlier this year by depletion of deposits, and the mill had been operating on stockpiled ore.



The *Homestake-New Mexico Partners* mill, the first mill to be built in the Ambrosia Lake district of New Mexico, is scheduled to go into operation this month. Ore shipments have already started from the Eartners mine which is in Sec. 32, T. 14-N., R. 9-W.

Werner Lake Nickel Mines Ltd. of Toronto, Canada is proceeding with reactivation of the old *Henry Clay* and *Atwood* copper mines near Lordsburg, New Mexico after extensive drilling and exploration of the property. Former owners had sunk a shaft to 400 feet and produced some 200,000 tons of ore. Considerable underground development is planned by Werner Lake, with a 200-ton-per-day mill also under discussion. A. Mahalek is in charge of the project.

A rare new mineral discovered near Grants, New Mexico has been named "santafeite" in recognition of the *Atchison, Topeka & Santa Fe Railroad* which pioneered uranium exploration and development in that area. Santafeite is a new hydrated vanadate discovered by Dr. Ming-Shan Sun, mineralogist for the New Mexico Bureau of Mines. It was found in 1951 on an outcropping of Todillo limestone near Haystack Mountain.

United Western Minerals Company has recently acquired leases from the U.S. Indian Bureau on about 2,240 acres in the Ambrosia Lake area of New Mex-

ico. The company plans to drill immediately on the east half of Sec. 28, T. 14 N., R. 10W. which lies to the south of *Kerr-McGee Oil Industries* large ore body and joined on the west by *Pacific Uranium Mines Company's* ore body on Sec. 27. A 100,000 feet of drilling is planned.

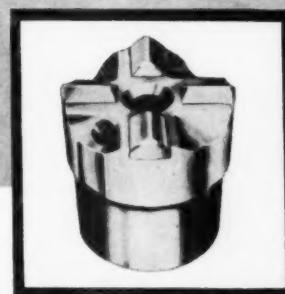
Texas-Zinc Minerals Corporation has not exercised its option on a group of claims in Sec. 34, T. 14 N., R. 10 W. of McKinley County, New Mexico. The company drilled to depths between 500 and 700 feet, and did not consider the results favorable enough.

Anderson Brothers Corporation hopes to have its new \$150,000 manganese mill in operation by the latter part of May 1958. The mill, located 25 miles southwest of Socorro, New Mexico, will have a capacity of from 720 to 1,440 tons per day.

The *Santa Fe Railway*, long Valencia County, New Mexico's leading taxpayer, was superseded by *Anaconda Company* this year. Anaconda's bill for ad valorem taxes amounted to \$529,404.95. Of this, \$8,900.07 is for taxes on assessed property within the corporate limits of Grants, New Mexico, and the remainder for the

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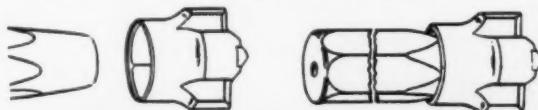
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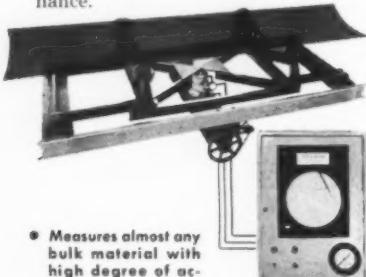
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Yucca Mining & Petroleum Company has turned over the rights to two new uranium milling processes to its subsidiary, *American Milling Corporation*, for the purpose of negotiating with firms desiring to use these methods in ore-extraction plants. One of the processes, created by Dr. Theodore Chester Crawford, is the electrolytic plating method of extracting uranium from ore. The AEC has granted permission to *American Milling* to purchase uranium ore without limitation as to quantity at an ore processing plant at Albuquerque, New Mexico. Yucca recently announced an ore discovery and continuance of drilling on the San Mateo Dome in Grants, New Mexico.

Calumet & Hecla Inc. is making steady progress with its shaft sinking near Grants, New Mexico. A 2,200-foot incline is being sunk in the San Mateo Dome to reach the ore body. Surface facilities have been installed, including an office, change room, and power plant.

production to 2,000 tons and is expected to be completed in October 1958. Formerly named La Quinta plant, it has been renamed the Sherwin for Ralph S. Sherwin, Sr., a former vice president and father of the present plant manager. When the Sherwin plant first started operations, 900,000 long tons of bauxite were required annually. Operation of the new unit requires another 450,000 tons, and the final unit will take an additional 450,000 long tons of ore, raising the annual total to 1,800,000 tons.

Copper refining operations at the El Paso custom smelter of *American Smelting and Refining Company* were reduced from a seven to a six-day week basis recently as a result of a reduction in the amount of copper concentrates being received. Plant manager Ben Roberts said the policy would continue indefinitely and would mean a reduction in production from 7,000 to 6,000 tons a month. He said the move was primarily caused by the shutdown of the *Banner* mine in Lordsburg, New Mexico. Operations in the lead-zinc section of the smelter will continue on a seven-day schedule.

E. J. Lavino & Company plans an \$8,000,000 project at Freeport, Texas to produce high-grade magnesite (periclase) from seawater. Until now, Lavino has purchased its requirements of magnesite for its production of basic refractories. The magnesia product will be shipped to Lavino's refractories plant in Pennsylvania. *Westvaco Division of Food Machinery & Chemical Corporation* which supplies periclase to the Lavino plant in Newark, California, will cooperate in the design of the new plant at Freeport. Operation is expected by the middle of 1959.



Reynolds Metals Company has completed a \$30,000,000 expansion at its Sherwin alumina plant at La Quinta, Texas, and the plant is now producing 1,500 tons monthly instead of 1,000 tons as before. Work on another \$16,000,000 phase is proceeding. This will increase

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INTERNATIONAL NEWS

Climax Molybdenum and American Metal Merger Will Make a New International Mining Giant

Directors of Climax Molybdenum Company and American Metal Company Limited have approved a plan to merge the two companies into a new firm to be called American Metal Climax, Inc. Approval of stockholders at the meetings on December 30th appears certain and will be aided by the fact that American Metal already owns 8.7 percent of Climax's outstanding shares and the Hochschild Family Holdings (controlled by American Metal officers) amount to 6.9 percent.

The two companies have had very close ties since before World War I. Membership on both boards has been held simultaneously by a number of company officers. More recently, the two companies have participated in joint ventures in oil and aluminum.

The new firm—American Metal Climax—will emerge as one of the world's most important mining, milling, smelting, refining, and marketing companies. Climax, based on 1956 production, will contribute molybdenum (37,489,000 pounds), tungsten (672,000 pounds), uranium, vanadium, pyrite, and tin. American Metals' production, including wholly owned subsidiaries, is harder to calculate. However, Southwest Potash Company mined 1,376,971 tons of ore in 1956. As a measure of American Metals' refining and sales position on a world-wide basis, the following 1956 sales are listed: copper, 490,000 short tons; lead, 281,000 short tons; zinc, 165,000; tin, 20,000; silver, 37,555,000 ounces; and gold, 899,000 ounces. Also important amounts of selenium, bismuth, lithium, beryl, germanium, tellurium, cadmium, (1,000 annual ton forecast), and platinum group metals. Both companies also produce oil and gas.

The new company will own 100 percent of Climax Molybdenum, 84.07 percent of Climax Uranium Company, 100 percent of Southwest Potash Company, 100 percent of United States Metals Refining Company (smelter and refinery at Carteret, New Jersey), 100 percent of Blackwell Zinc Company, Inc. (retort zinc smelter at Blackwell, Oklahoma), 98.6 percent of Cia Minera de Peñoles, S. A. (Mexican lead-zinc mine), 75 percent of Cia Metalúrgica Peñoles, S. A. (Mexican lead smelter and refinery), 75 percent of Heath Steele Mines Limited (lead-zinc-copper mine and mill in New Brunswick), and, 50.61 percent of Rhodesian Selection Trust Limited. Also 32.65 percent of Roan Antelope Copper Mines Limited.

Rhodesian Selection Trust's holdings and Roan Antelope's are listed below.

Other major mining interests the firm will hold include 25.5 and 1.87 percent of Tsumeb Corporation Limited, 19.72 percent of O'okiep Copper Company Limited, 37.5 percent of San Francisco Mines of Mexico Limited, 29.41 of Mazapil Copper Company Limited, 17.51 of

Copper Range Company, 7.43 of Consolidated Coppermines Corporation, 21.25 of Bikita Minerals Private Limited, and 7.2 of British Aluminum Company Limited.

In addition, exploration and prospecting ventures of the two merging firms are noteworthy: for molybdenum in central Colorado, for copper in Michigan's Upper Peninsula where 50,600,000 short tons of 1.52 percent copper shale plus 54,400,000 short tons of 1.04 percent copper shale have been developed, and 11,000 square miles of mineral concession surrounding Tsumeb's mine.

It is planned to operate Climax Molybdenum as a separate division with Weston G. Thomas as president. Some idea of Climax's mining and metallurgical costs (exclusive of depreciation, accelerated amortization, sales development and research expense, administration and general expenses, dry hole and pension plan costs) can be gained from the fact that for the first six months of 1957 they totalled \$17,543,000. During the same period Climax mined 5,327,000 tons of molybdenum ore. Of course, these costs include Climax Uranium costs, too; which, however, are only a small fraction of the molybdenum costs.

What is gained by the merger? More diversification, increased volume, pooling of engineering and managerial talent, a chance for American Metal to expand further into mining and United States holdings, and, for Climax, the utilization of excess working capital.

Domestic consumption of rutile has increased more than 350 percent in recent years. In 1956 50,000 tons were used as compared with an average consumption of 11,000 tons in the period from 1947 to 1951. The large increase is attributed to increased use of arc welding (rutile is used for the coatings of arc welding electrodes) and the recent development of the use of rutile in producing titanium metal.

Strategic, Gunnar Join To Produce Chromite

A new company, Strannar Mines Ltd., has been formed by Strategic Materials Corporation and Gunnar Mines Ltd., to develop chrome claims owned by Gunnar, Nesbitt LaBine Uranium Mines, and Chromite Mining Corporation Ltd., in the Cat Lake-Bird River area of southeastern Manitoba, Canada. Under the terms of the agreement, the Gunnar group will direct the mining operations of Strannar, and Strategic will supervise and conduct the subsequent electric furnace operations.

Strategic receives one-half of the common stock equity in Strannar Mines in

return for granting the new company exclusive Canadian rights to use the Strategic-Udy process for the treatment of low-grade chromite-bearing ore, and for other considerations. It is understood that erection of a smelting plant at the Lac du Bonnet property is expected.

The Cat Lake properties may possibly contain the largest known chromite deposit in the country. Indicated reserves are estimated at 11,000,000 tons in the main deposit, with an average grade of 4.6 percent Cr_2O_3 , and a secondary deposit of 675,000 tons averaging 6.7 percent Cr_2O_3 . Diamond drilling at the Bird River property has indicated a large tonnage deposit but no estimates have been released.

Aardal III To Increase Norway's Aluminum Output

A/S Aardal og Sunndal Verk, Norway's state-controlled aluminum works, has announced plans to further expand production with the addition of a new plant, Aardal III. When this project is completed, the company's plants at Aardal and Sunndal will have a combined capacity of nearly 150,000 tons annual aluminum plant has to date.

Aardal II, now under construction, is scheduled to begin operations in 1961 with an estimated annual output of 36,000 tons. Aardal I turns out 28,000 tons a year; Sunndal I about 40,000 tons; and Sunndal II, not yet completed, will produce approximately 10,000 tons a year.

The newest plant will begin initial production in 1963, with annual production of 32,000 tons expected by 1965. Additional hydroelectric power for the plant will be provided by installing a sixth generator at the Tyn power plant and raising the level of the Tyn dam mere than 9 feet.

Another new electrolytic aluminum plant, developed by Elektrokemisk A/S and the Swiss AlAG at Mosjøen in northern Norway, will begin initial production this spring. Production from this plant is expected to reach 20,000 tons a year at the end of the first construction stage, increasing to 90,000 tons when the plant is completed.

Expanded Steel Output Is Russia's 5-Year Goal

According to Russia's current 5-year plan, by 1960 the Soviet Union will produce more steel, electric power, cement, and fuel than the present combined production of Great Britain, France, and Western Germany. Industrial output will have increased by approximately 65 percent during the period from 1955 to 1960.

Steel output is expected to reach 68,300,000 tons by 1960, an increase of 23,000,000 tons from 1955 production. Dozens of blast and open-hearth furnaces will be built in the current five-year period. In addition to the increase in number of plants, the latest technological methods for production of iron and steel use oxygen-enriched blast and vacuum melting and teeming of steel. Centrifugal and semi-continuous pipe casting will also be adopted. Already at several Soviet plants, molten steel is directly converted into billets for rolling, which eliminates the teeming into molds and processing of

Company	Ore Reserves	Grade	Ore Milled (1957)	Grade
	Tons	Copper	Tons	Grade
Mufulira Copper	151,115,000	3.35%	4,498,645	2.88%
Chibuluma Mines	6,652,311	5.10%	460,822	5.89%
Chambishi Mines	35,000,000	3.37		
Baluba Mines	70,000,000	2.68		
Roan Antelope	95,168,000	3.09	5,825,800	1.95%

1. Also 0.24 percent cobalt. 2. Also 0.36 percent Co. 3. Also 0.18 percent Co.

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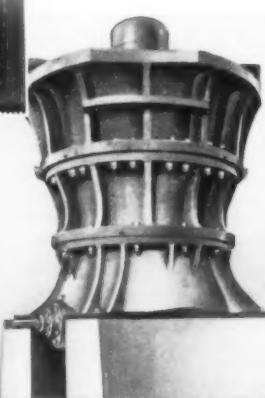
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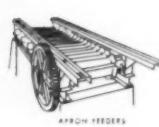
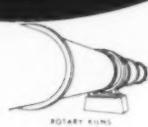
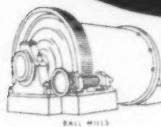
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ingots in blooming mills. Future plans include special shops for continuous metal casting to be installed at large iron and steel plants such as those at Magnitogorsk and Kuznetsk.

In line with the increased iron and steel production, more than 20 major open-pit iron ore mines have been put into operation recently, and 30 more mining projects are underway. The pits to be developed in the near future will produce more than 17,000,000 tons of iron ore annually.

Establishment of a metallurgical center in East Siberia is also planned. In 10 or 15 years, an annual pig iron output of between 15,000,000 and 20,000,000 tons is expected from this development.



QUEENSLAND—*Aluminum Laboratories Ltd.*, a subsidiary of *Aluminum Company of Canada*, is negotiating with the Queensland government for permission to mine and export bauxite from the Cape York Peninsula. It is seeking extensive leases covering a new bauxite discovery near *Consolidated Zinc Corporation's* leases. The company is surveying areas in Cape York Peninsula to determine whether the quality of ore warrants the establishment of a Canadian mining organization in Queensland. *Consolidated Zinc*, meanwhile, has taken 2,000,000 shares in its subsidiary firm, *Commonwealth Aluminum Corporation Ltd.*, and has already paid £480,000 to the company in order to make funds available for development of the Weipa field. Its agreement with the Queensland government provides for construction of a new harbor, town site, and initial treatment plant at Weipa.

REPUBLIC OF THE PHILIPPINES—It is expected that the Philippine legislature will consider amendments to the mining laws regulating development of government reserves in its next session which starts this month. The government's recent call for bids for operation of the nickel deposits in the Surigao Mineral Reservation brought no bidders and pointed up the fact that the government's terms are not attractive to prospective private operators. Some of the unpopular conditions include: quarterly payment to government of 5 percent of quarterly gross profits or 50 percent of the net profits (whichever is higher) of the operation; a required initial outlay of Pesos 30,000,000 and eventual investment of Pesos 100,000,000 over the 25-year duration of the contract. The Surigao deposits are estimated to contain 144,500,000 short tons of nickel ore.

NEW SOUTH WALES—*Mineral Ventures N.L.* will test drill the *Kangiara* mine near Yass. Up to 1922, the mine had produced about 40,000 tons of ore containing 6,500 tons lead, 427,000 ounces silver, 1,200 tons copper, and 2,900 ounces gold. The mine was worked only up to the 400-foot level and is considered a promising prospect. Several thousand feet of diamond drilling may be necessary to delineate fully any extension of the ore body to the south which preliminary examination indicates as likely.

NEW ZEALAND—The government has announced the largest power development program in New Zealand history. Cost of new projects to almost double present generating capacity will be £N.Z. 235,000,000. By 1970, the country is estimated to require an additional 983,000 kw. of installed capacity, of which 803,000 kw. will be needed in the North Island. The recently completed Roxburgh station on the Clutha River will supply the needs of South Island until 1965 when the proposed Benmore station on the Waitaki River will be completed. Capacity planned for Benmore is 480,000 kw. Interconnection of the two island power systems across Cook Strait will be by cable designed for a capacity of 600,000 kw. and capable of expansion.

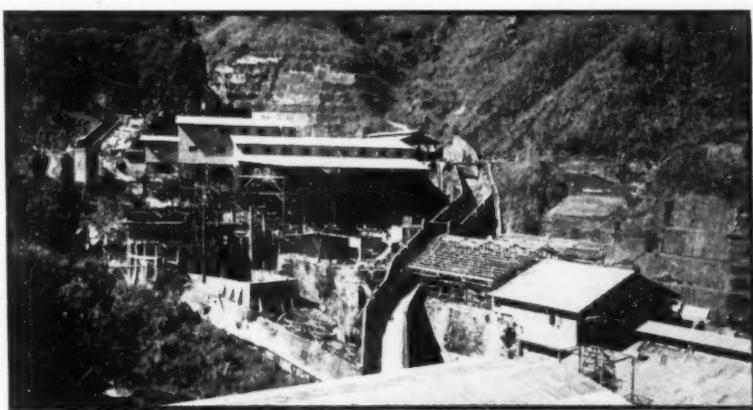
SOUTH AUSTRALIA—The Australian demand for barite, estimated at 7,000 tons per year, can now be met by a plant recently installed at Quern, about 200 miles north of Adelaide. In addition to the above output, it is hoped to export to New Zealand; the company is also negotiating with oil companies to supply barite in the Near East, Indonesia, the Philippines, and New Guinea. *South Australian Barites, Ltd.* has already obtained one contract for 550 tons to be supplied to the *Australian Atomic Energy Commission*. The barite deposit is at Blinman, about 100 miles north of Quern. (Ore is trucked to Hawker and then railed.) Cost of the plant, which was designed in collaboration with the S.A. Mines Department, was £150,000. On a two-shift basis, output is rated at 10,000 tons per year, and this may later be increased by 50 percent.

INDONESIA—The mining of tin is said to be growing more difficult. This is the country's third most important export item and it is mined on Bangka, Belitung, and Singkep. From January to August of 1957, 16,484.5 tons were exported, as compared with 19,590.1 tons in the same period of 1956. Production figures for those periods were, respectively, 17,052.2 and 19,049.6 tons.

TASMANIA—The 1958 convention of the *Australasian Institute of Mining and Metallurgy* will be held in Tasmania in February. Program will include visits to Mt. Lyell, Rosebery mines of *Electrolytic Zinc Company of Australasia*, various industries around Hobart, and optional visits of *Aberfoyle Tin N.L.* at Rossarden, *Aluminum Commission* plant at Bell Bay, and *King Island Scheelite (1947) Ltd.* at King Island.

NEW ZEALAND—West Coast gold dredges of *Arahura Gold Dredging Ltd.* and *Kanieri Gold Dredging Ltd.* are claimed to be the world's lowest operating cost units (5 to 6 pence, N.Z., per cubic yard treated). In five months of the current fiscal year, results were as follows: Arahura dredged 1,120,000 cubic yards for a recovery of 4,009 ounces of gold bullion; Kanieri dredged 1,786,000 cubic yards to recover 5,333 ounces bullion.

REPUBLIC OF THE PHILIPPINES—Local copper producers have drawn up a list of recommended assistance measures. The provisions include: reduction of rates of duty on all mining imports by 50 percent through presidential action; more lenient interpretation and more liberal policy on tariff, and special tax classification on imports of mining machinery, equipment, and supplies by customs commissioners; liberal implementation of present barter law by (a) giving bona fide copper producers 100 percent barter privileges, export and import freedom to trade with any country, triangular barter transactions, barter of "end products", barter export permits valid for six months, extension of barter rights to import to six months from date of exportation; (b) simplification of present requirements in support of barter applications; and (c) granting privileges which should not operate to reduce dollar allocations for expansion or for special cases nor to reduce quotas already granted; liberal loans terms by government financial institutions.



Itogon Mill Turns Out Record Production

The Itogon mill, pictured above, of Itogon-Suyoc Mines Company at Baguio in Mountain Province, Republic of the Philippines, produced 2,853.88 ounces of gold and 1,371.32 ounces of silver from 17,695 tons of ore treated in October. This is the largest production in the last 21 months of operation. The increase was attributed to greater tonnage being milled as well as mining of better grade ore. Production is expected to increase further when the mill reaches its present goal of 650 tons daily. Development work was also encouraging, with more footage "in ore" driven in October than in the previous month.

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RUSSIA—Discovery of a large deposit of magnetite iron ore has been reported south of the Kokchetav region in Kazakhstan, with ore reserves estimated at hundreds of millions of tons. Another 50,000,000 tons of magnetite iron ore are believed to be contained in a deposit discovered near Lake Atansor. The Lake Atansor ore is close to the surface and can be mined by open-pit methods.

EIRE—*Silvermines Lead & Zinc Company, Ltd.* has received joint proposals from the United States companies, *Cyprus Mines Corporation* and *Cerro de Pasco Corporation*, for exploration and mining rights on all Silvermines' properties, with the exception of the *Shallee* deposit. No definite commitments have yet been made.

NORWAY—*A/S Titania* plans to invest 75,000,000 kr. in installing new facilities and expanding its present exploration work at the ilmenite deposits near Jossingfjord in western Norway. Another 7,000,000 kr. will be spent on developing more effective methods of working the deposits, which are now believed to be larger than indicated by previous exploration. Reserves are estimated at 350,000,000 tons, with 166,000,000 tons already developed. Titania's present production is approximately 200,000 tons of ilmenite concentrate annually. Development of the new deposits, expected to be completed in 1960, will double the present production figure.

FINLAND—*OY Vuokkenniska AB*, which operates iron works at Imatra and Turku, has acquired mining rights to an iron ore deposit recently discovered beneath sea level on Jussaro Island, near the southwestern coast of Finland. The deposit is believed to contain 250,000,000 tons of 25 to 30 percent iron and manganese ore. Production will begin next year. Another iron ore deposit has been reported in Loimaa, southwestern Finland, with ore containing 70 percent iron. The size of the deposit is still unknown.

SWEDEN—*The Luossavaara-Kiirunavaara Company* has undertaken exploration of iron ore deposits in a 100 square kilometer area located between Jukkasjarvi and Svappavaara in northern Sweden. The project is scheduled over a 10-year period, and initial drilling footage will be 25,000 metres.

EIRE—The *Mountain* mine, under development by *Can-Erin Mines, Ltd.*'s subsidiary, *Emerald Isles Mining Company*, has been dewatered to 600 feet below the adit level. Sampling in the backs of a narrow drift on the 480-foot level and through the unmined block of ore between the 360-foot and 600-foot levels showed widths from 2.0 to 6.1 feet, with copper content of 4 to 11 percent. The company's consulting geologist, J. D. McCannell, believes the silicified zone containing these samples to be as much as 80 feet in width. Future plans include flat diamond drilling into the walls to determine the actual width of the copper mineralization.

FINLAND—A valuable nickel and copper deposit has been discovered at Kotalahti, Leppavirta, in central Finland. The *Outokumpu Company* will begin mining operations there as soon as possible. It is believed that the Kotalahti mine will be the largest nickel mine in Europe, other than those located in Russia.

PORUGAL—*Beralt Tin & Wolfram Ltd.* has announced plans for further increase in the production of tin concentrates. The rate of production has already risen to nearly 40 tons per month. Nearly all the extra output will come from the Vale De Ermida and the Argimela properties, which are now under development.

THE NETHERLANDS—Construction of a 500,000-ton storage capacity transhipping station is underway at Rotterdam, Holland by the *Iron Ore Company of Canada*. This installation will enable the company to handle orders for several million tons of European ore yearly, as ore can be loaded into barges for delivery to ports on the Rhine, England, France, and elsewhere along the coast. The Rotterdam station will be similar to the company's installation at Contrecoeur, Canada (near Montreal) where ore is taken from large river vessels for delivery in smaller ships or by rail to the United States. With the new facilities, IOCO expects to obtain a larger share of the European market, which consumed 1,800,000 tons of 12,000,000 tons shipped by the company in 1956.

GREECE—The *Austrian-American Magnesite A. G.* recently purchased the magnesite works at Chalkidike. The works are reported to be in poor condition, but following repair of the rotary kiln, production is expected to reach 23,000 tons of magnesite sinter annually.

GERMANY—The *Gewerkschaft Mechernich Werke Lead Mines*, located near the German-Belgian border, will shutdown, according to recent reports. The decision was made by the *Board of Preussische Bergwerke & Huetten A. G.* owner of the mines following extensive geological research of the present lead deposits at Mechernich. It is believed that the current low price of lead in West Germany (1,000 marks per ton compared to production costs of 1,500 marks per ton) has resulted in unprofitable working of the mines.

SWEDEN—Most of the privately owned stock in the *Luossavaara-Kiirunavaara A/B* has been taken over by the Swedish government in accordance with option terms in the mining concession which was granted 50 years ago. The stockholders will be paid approximately \$180,000,000 over a period of years. The company is mining iron ore deposits at Kiruna and Malmberget in northern Sweden, which yielded 13,800,000 tons of ore in 1956.

EIRE—A survey of old lead and zinc mines in Caim, County Wexford, is now underway. The properties have not been active for 100 years.

AUSTRIA—Uranium mineralization has been reported found at Mallnitz, province of Salzburg; Zillingdorf, province of Burgenland; Nuefeld, province of Lower Austria, and Trimmelkan, province of Upper Austria. According to a recent Austrian geological report, 1 kilo of uranium can be extracted from 25 tons of coal from Trimmelkan. Further exploration is underway along the Danube River by the *Austrian Study Organization for Atomic Energy*.

GREECE—A survey of recently discovered chrome and manganese ore deposits on the island of Lesbos is report-

INTERNATIONAL

edly planned by the Greek Geological Institute.



AFRICA

UNION OF SOUTH AFRICA—Western Deep Levels, Ltd. has completed erection of four headframes at its property in the Transvaal, and shaft sinking has already started at one. This will be the world's deepest gold mine, with planned depth at 10,000 feet. In the initial stages, four vertical and subverticals and adjoining ventilation shafts will be sunk—16 in all for the northern section. Two systems have started, Nos. 2 and 3, to service the northcentral portion 8,500 feet apart. Each consists of a 26-foot-diameter hoisting shaft and a 20-foot-diameter ventilation shaft. Ultimate depth will be 6,000 feet and then subverticals will carry on. Two similar systems will be sunk in the east and west sections of the property. Eventually, tertiary systems will be sunk in the deep sections. Initial milling rate will be 100,000 tons a month, planned to increase to 200,000 tons. Estimated output when in full production will be about 120,000 ounces of gold per month. Present highest output is reported to be 72,000 ounces.

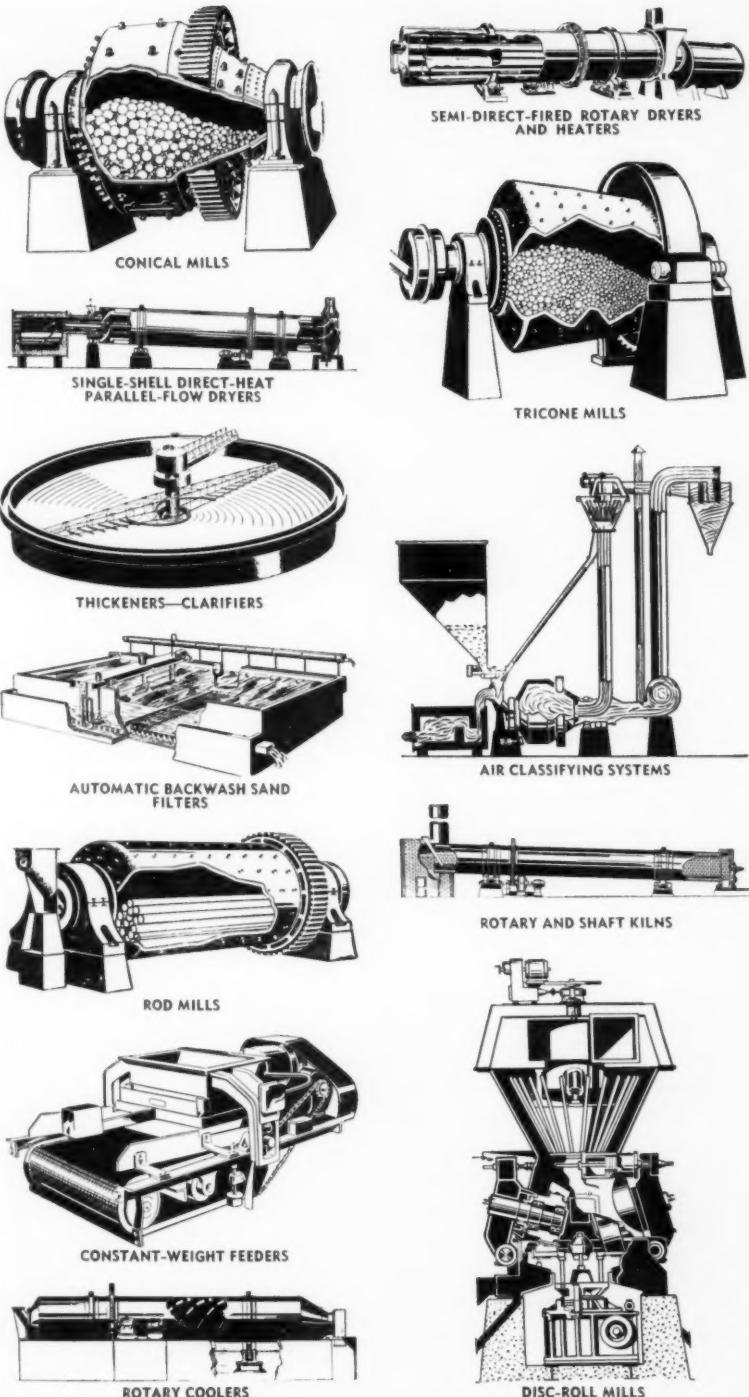
TANZANYIKA—Western Rift Exploration Company Ltd., which was formed recently by Newmont Mining Corporation, Anglo-American Corporation of South Africa, British South Africa Company, and Tanzanypika Concessions Ltd. to prospect a 34,000-square-mile concession (see MINING WORLD, November 1957, page 99), has already started aerial survey work. Intensive prospecting, particularly for radioactive minerals, is planned.

FEDERATION OF RHODESIA & NYASALAND—Kansanshi mine of Kansanshi Mining Company in Northern Rhodesia has been shut down because of flooding in lower level workings, coupled with the low price of copper. Damage has been estimated at £500,000, and so rehabilitation will be suspended until the copper price improves although pumping to remove water has started. Production had reached about 400 tons of copper per month in concentrate since milling started in 1956. It was transported 110 miles to the railhead at Nchanga.

SOUTHWEST AFRICA—Anglo American Corporation of South Africa Ltd. is reported to have discovered uranium in the Namib Desert. Though the exact position of the deposits has not been revealed, nor the grade of the ore, it has been announced that the deposits extend about 15 to 20 miles along the strike and have a width of one-half mile. This is the first really promising discovery of uranium in the country.

GHANA—Consolidated African Selection Trust Ltd. plans to erect an £800,000 washing plant in order to develop lower grade diamond deposits. The plant is to be completed in 1961. The company is also spending £550,000 on a new plant in Tongo, Sierra Leone.

FRENCH WEST AFRICA—The MIFERMA company (*Societe des Mines de Fer de Mauritanie*), formed to examine the possibilities of the Fort Gouraud iron ore deposits in Mauritania in 1952, in-



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creased its capitalization from 875,000,000 francs to 4,000,000,000 by the end of 1957, and then will increase to 20,000,000,000 or 25,000,000,000 before the end of 1958. The title of the company has been altered to "exploitation" company and Paul Leroy Beaulieu has been named president. Negotiations are in progress with the Spanish government for an agreement to build a railroad to move the ore from Fort Gouraud across the Spanish colony of Rio de Oro to Port Etienne. France remains the majority stockholder in MIFERMA, but with 51 percent of the stock instead of 55. British Iron & Steel Corporation's share is to be increased from 15 percent to 20 percent. German and French interests are also represented, and a Netherlands group may also participate if current talks are successful.

NIGERIA—Amalgamated Tin Mines of Nigeria Ltd. plans to purchase additional equipment in order to increase production of tin concentrates. At the same time, the company will be prepared to increase columbite production if and when the metal price rises to a more economic level.

BELGIAN CONGO—Geamines has opened the second hydroelectric plant on the Luvua River at Piana-Mwanga, 70 miles from Manono, Katanga Province. The new installation consists of two Kaplan turbines generating 12,000 kw. A third turbine can be added without difficulty should the need for extra power arise. All of the civil engineering work was done by Geamines, which also manufactured a part of the equipment in its own workshops.

SWAZILAND—High-grade iron ore has been discovered in the vicinity of the capital of Mbabane and, according to the High Commissioner in London, the extent of the ore immediately in sight is 30,000,000 tons. It is also believed that there are another 30,000,000 tons of equally good high-grade ore not very far from where the first discovery was made. No details are available yet concerning the companies which will take an interest in the mineral concessions in question, but it can be expected that several British companies will be involved. It appears certain that if these deposits are developed, Swaziland will get its first (and much-needed) railroad. The nearest port is Lourenco Marques in Portuguese East Africa about 100 miles away.

PORTUGUESE GUINEA—The Japanese are reported to be considering assisting in the development of tin mines in Portuguese Guinea. A survey is being made on behalf of the Federation of Economic Organizations in Tokyo by the Director of the Secretariat of the Japanese National Committee of the International Chamber of Commerce.

BELGIAN CONGO—The new concentrator planned for installation at the Kambove copper mine in Katanga province will not be installed until the overburden at the mine site has been cleared. It is expected that this will take about two years.



LATIN AMERICA

GUATEMALA—Bunker Hill Company, with extensive holdings in the Coeur

d'Alenes of Idaho, is planning an intensive search for lead and zinc in Guatemala. Company officials made a preliminary examination late in 1957 of the possibilities of exploring the country and decided to undertake the program. So far the firm holds no leases or options in Guatemala.

JAMAICA — *Harvey Aluminum* has been granted exclusive licenses to prospect for bauxite on government land in six parishes of the island. Initially the company will start on an area of about 642 square miles under an agreement which covers a three-year period. Crews have been sent to the island to start work in the parishes of Trelawney, Manchester, St. Ann, St. James, St. John, and Portland.

MEXICO — *United Western Minerals Company* has acquired an option on a Mexican tungsten property and is proceeding to examine it.

PERU — *Compania Explotadora de Hierro de Acari* has started development of the Acari iron deposits south of Lima. First steps are construction of a new pier at San Juan Bay and a 50-kilometer highway connecting the port with the mine. It is expected that development work will take about 18 months and will cost about \$7,000,000. The claims cover 25,000 hectares of ore-bearing land located about 50 to 60 kilometers east of the 600-square kilometer iron ore concession of *Corporacion Peruana del Santa* now being developed by *Marcona Mining Company*. Unlike the Marcona concession, however, which is on fairly level land, the Acari deposits are in the Andes foothills at elevations ranging between 800 and 1,100 meters. Mining will be both by open pit and by tunneling. First shipments are expected about the middle of 1958 at a rate of 1,000,000 tons annually, increasing to 3,000,000 tons. *Panamerican Commodities S.A.* formed the new firm with the assistance of United States capital.

BOLIVIA — The *Corporacion Minera de Bolivia*, the government's mining agency, is making a serious effort to pull its nationalized mines "out of the red". Several so-called marginal mines which are working at a loss will be closed; the miners will be shifted to privately operated mines, or returned to the agricultural districts from which many of them came. There is some resistance to these plans from the trade unions, but more and more people are beginning to understand that drastic measures must be taken to save the community. The administration wants the small mining enterprises to get back on their feet since they have contributed so much to the former prosperity of the country. Improper legislation and mismanagement have practically destroyed this group. Many of the steps taken so far were suggested in the report of the U. S. firm of Ford, Bacon & Davis, consulting engineers.

MEXICO — A group of Texans and Mexicans are now studying a plan for completing a paved highway connecting the Big Bend National Park with Muzquiz 120 miles southeast. Such a highway would open up the rich farming and mining country in Coahuila. The *Florita de Mexico* which mines fluorspar in Coahuila state has already constructed a gravel road from Muzquiz to Rancho Encatada.

PERU — *Foley Brothers* have completed the \$3,000,000 mole and pier at Ilo for *Southern Peru Copper Corporation*. The

pier is 600 feet long and 60 feet wide, sufficient to accommodate four standard gauge railway track and also provide a truck area. The first ocean steamer to use the new facility was the S.S. Santa Olivia of the Grace Line which discharged 3,000 tons of coal.

BRAZIL — *St. John d'el Rey Mining Company*, which has been producing gold in Minas Gerais state for 126 years, is currently in a dilemma because the decreased internal value of the cruziero has not kept pace with the cruziero-U.S. dollar rate. If the company ceases to operate its mine, it will incur a liability to its workmen of about £3,000,000. To raise this amount, the company might be obligated to sell its immense iron ore deposits. To overcome this difficulty, Leo Model of the New York firm of Model, Roland, and Stone has provided £65,000 as security for a bank loan to pay current wages and it is proposed to issue up to £1,000,000 of 7 percent convertible income debenture stock. This agreement is designed to gain time in which to discuss with the Brazilian government means of eliminating the gold mining losses. Since 40,000 people depend upon the activities of St. John d'el Rey, it is to be expected that all aspects of the situation will be carefully considered.

ARGENTINA — *Coney Argentina S.A. (CASA)* has purchased 2,300,000 acres of land in Mendoza province for its extensive mineral reserves. Numerous deposits including silver, lead-zinc, iron ore, graphite, salt, and coal are said to be on the property, with several mines already in production. There is a small producing oil field, as well as deposits of gilsonite and asphalt. Copper deposits in the Andes near the Chilean border are reported to be quite large. At the southeast point of the property, the government is completing work on the Nihuil Dam and hydroelectric plant which will provide power for the immediate area as well as

for the lower coastal regions of Argentina. Joseph J. Coney of San Francisco heads the new firm.

BRAZIL — Large iron ore reserves in the interior of Minas Gerais state are receiving considerable attention from foreign companies. According to the government's National Development Bank, three nations have offered to build railways to move the ore: the German *Ferrostaal* syndicate, the Polish government, and *Kaiser Engineers International* of the United States. A group of Japanese companies have presented a plan for developing existing facilities. The German *Mannesmann Company* has opened a seamless steel tube plant in the state, and the French *Schneider* group has long had an interest in the *Belga Mineira* iron and steel plant in Minas Gerais. Also, a group of Cleveland, Ohio investors have offered to buy shares in Brazilian mining enterprises, leaving control with the Brazilians.

BOLIVIA — *W. R. Grace & Company* is looking more intently into the mining industry in South America. The firm has appointed J. Thomas as its consulting engineer in Peru, Chile, and Bolivia. Mr. Thomas is a British mining engineer, born in Mexico, who has worked in Bolivia for many years. He was general manager of the *Empresa Minera Unificada del Cerro de Potosi*, and of *American Smelting de Bolivia*, which operated the *Corocoro* property. For some years he has also been consulting engineer of *Chavin Mines* in Lima, Peru. W. R. Grace & Company operates the *Chojilla* mine (tungsten) and the *Tanapaca* in Bolivia. In the latter mine they recently found good ore and monthly tin production has been increased five-fold. Through the *International Mining Company* which it controls, Grace has taken an option on the *Ocuri* property (originally Chilean owned) and will sample the gold placer again.



Anaconda Opens New Copper Mine in Chile

Formal inauguration ceremonies were held recently at the Anaconda Company's new copper mine, La Africana, located 10 miles from Santiago, Chile. Development of the mine was begun in 1955 and since then a mill has been constructed. Annual production of 20,000 metric tons of 25 percent copper concentrate is expected. In the picture above, Anaconda's board chairman, Roy H. Glover, addresses the crowd. In the background are the mill and mine headframes. The property is operated by Santiago Mining Company, a subsidiary of the Anaconda Company.



JAPAN—*Furukawa Magnesium Company* has agreed to deliver seven tons of primary magnesium (containing 99.97 percent Mg) in exchange for fluorite from Communist China. All magnesium exports had been suspended by the government since June 1956 because of increased domestic requirements for the metal. Previously Japan needed to import about 5,000 tons annually but increased production from Furukawa, (the only magnesium refinery in Japan), coupled with a decline in domestic consumption, has resulted in a surplus. (The local Japanese titanium industry is a prime user of magnesium and its exports to the United States have declined.) Present output of the Furukawa firm is approximately 2,000 tons annually. Dolomite, used as the raw material, is mined near Tokyo. Government restrictions on magnesium imports and permission to export within a limit of 500 tons is expected to continue to March 1958 in accordance with present supply and demand.

MALAYA—*Kamunting Tin Dredging Ltd.* is negotiating for the purchase of about 116 acres of tin-bearing land near where its No. 6 dredge has been working. The latter was to be dismantled and moved to a new site after its reserves were depleted. This would have meant

taking the dredge out of action for some time, so the company is seeking this new arrangement which would allow the dredge to continue working its present course toward the new ground.

JAPAN—*Dowa Mining Company* reportedly has located a copper-zinc-lead-iron sulfide deposits in its *Kosaka* mine containing about 39 percent copper. Drilling is now being carried on to delimit the extent of the deposit. Reserves are estimated at 1,000,000 tons. In the 1920's the *Kosaka* mine was operating as an open-pit, the largest in the Orient. However, since the 1930's the open-pit operations have been largely suspended and production has been only about 120 to 130 tons of cement copper monthly for the smelter.

TURKEY—The French chemical, aluminum and ferro-alloy producer, *Pechiney*, has received a contract from the *Eti Bank* to supply technical assistance for construction of an 8,000-ton ferro-chrome plant in Turkey. *Pechiney* will supply machinery and equipment as a 40 percent contribution toward the capital of a new firm. It will also market the material abroad.

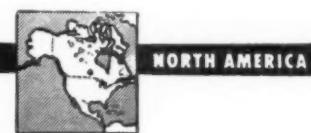
INDIA—India and Japan have reached an agreement for increased exports of Indian iron ore to Japan in return for Japanese assistance in developing iron ore mines, railway and port facilities. When the project gets underway, Japan expects to be purchasing 6,000,000 tons of iron ore annually. This is 40 percent of the total ore requirements of the Japanese steel industry. Japanese collaboration will be for the development of *Vishakapatam*

port on the east coast of India, and a rail link to be established with *Rourkela* where West Germany is assisting in building of a 1,000,000-ton steel plant. It is expected that Japan and India will approach the United States for financial assistance from the special \$100,000,000 fund created by President Eisenhower specifically for financing development projects on which two or more countries collaborate.

MALAYA—Twenty-two gravel pump mines were out of action this past fall because of severe damage from floods. The mines affected were in the *Kepong*, *Segambut*, *Kundang*, and *Ampang* areas around *Kuala Lumpur*. The loss in tin output amounted to about \$1,000,000.

JAPAN—*Japan Mining Company's Iwakuni* mill with a monthly capacity of 7,500 tons of ore has gone into production. The mill will yield 3,570 tons of pyrite, 260 tons of zinc concentrate, and 175 tons of copper concentrate monthly.

CYPRUS—The *Esperanza Copper & Sulphur Company, Ltd.* has begun treatment of its *Limni* deposit of semi-oxidized ore. It is estimated that about 7,000 tons of cement copper (averaging 65 percent metal) will be recovered from the 600,000 tons of ore averaging 1.74 percent copper and a small amount of silver and gold. A leaching process is used for recovery.



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ONTARIO—*Phelps Dodge Corporation* has formed a Canadian exploration subsidiary, *Phelps Dodge Corporation of Canada*, with offices in Toronto. Heading the exploration program will be W. A. Hutchison as general manager. He was formerly managing director of both *Northspan Uranium* and *Preston East Dome Mines*, two *Rio Tinto*-controlled firms. *Phelps Dodge* recently acquired a five-year exploration and development lease on a group of claims adjoining property of *Bethlehem Copper Corporation* in Highland Valley, British Columbia.

NEW BRUNSWICK—The \$3,000,000 spur line to *Heath Steele Mines Ltd.*'s lead, zinc, and copper mine has been officially opened by *Canadian National Railways*. About 120,000 tons of lead-zinc-copper concentrate is to be carried over this line annually. *Heath Steele* started production this summer. Its mill capacity is 1,500 tons of ore daily and reserves are set at more than 8,000,000 tons.

QUEBEC—*Spar-Mica Corporation Ltd.* has made its first shipments of feldspar from its new property at *Cape Feldspar* about 700 miles northeast of *Montreal*. The company's mill went into operation during the past summer and has reached an annual rate of 90,000 tons, about 90 percent of rated capacity. When in full production the plant is expected to produce 100,000 tons of feldspar concentrate, and 60,000 tons of quartz tailing byproduct for which the company hopes to develop a market. An additional byproduct will be 8,000 tons of ground muscovite mica. The firm has 2,600 acres, but work has centered on a 25-acre section where diamond drilling has outlined 7,654,000 tons of ore. Mining is by open

INTERNATIONAL

pit. A great advantage is the location of the deposit, right on deep water where the company has built a dock from which 10,000-ton vessels can be loaded. The first shipment went to Camden, New Jersey where the company has a subsidiary, *Golden-Keene Company*.

BRITISH COLUMBIA—A major copper-iron deposit is indicated at the property of *Craigmont Mines Ltd.* near Merritt in the Highland Valley. Diamond drilling has indicated 15,000 tons of ore per vertical foot, grading 1.76 percent copper and about 35 percent iron. Looking ahead to a full-scale operation, the firm has applied for the right to use 20 cubic feet of Nicola River water per second. The company also has acquired 31 additional claims, bringing its total to 124 claims and extending the property to the boundary of ground under exploration by *Kenecott Copper Corporation*.

GREENLAND—*Northern Mining Company* has shipped 13,650 tons of zinc concentrates and 8,750 tons of lead concentrates to Western Germany and Belgium from its lead-zinc mine at Mesters Vig during its first year of operation. (For complete details on this operation, see *Mining World*, November 1957, page 46-50.)

ONTARIO—Substantial headway is being made on construction of the Moose Mountain plant by *M. A. Hanna Company* at Sellwood, scheduled for completion in May 1958. The plant is designed to process 3,300 long tons of ore every 24 hours and to produce approximately 670,000 long tons of iron concentrates per year. The beneficiation facilities will consist of ore crushing and concentrating plants, including grinding mills and magnetic separation equipment. Ore will be mined from open pits at the reopened *Moose Mountain* mine and trucked to the plant.

BRITISH COLUMBIA—Because *Aluminum Ltd.* has decided to curtail certain phases of its expansion program, *Aluminum Company of Canada*, a wholly owned subsidiary, will postpone completion of 80,000 tons of ingot facilities at Kitimat. The capacity at that installation will remain at 180,000 tons per year for the present. However, the deferral will be carried out in such a way that it will permit completion of these facilities on short notice if necessary.

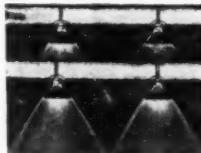
QUEBEC—*Quebec Lithium Corporation*, a subsidiary of *Sullivan Consolidated Mines Ltd.*, will build a \$3,000,000 lithium refining plant at Rouses Point, New York which is just across the Canadian border. The plant is scheduled for completion in 1959. Ore will be shipped from Quebec Li'lum's mines in northwest Quebec, about 500 miles from the plant site.

ONTARIO—*Pigeon Molybdenum Mines Ltd.* has been formed to take over 12 claims in Echo Township some 20 miles southwest of Sioux Lookout. The molybdenite prospect was optioned by *Rio Canadian Exploration Ltd.* from *Candor Exploration Ltd.* and *Mid-North Engineering Services Ltd.* Previous owners had carried out a limited amount of drilling and had driven a short adit for bulk sampling. *Rio Canadian*, which is the exploration subsidiary of *Rio Tinto Mining Company of Canada*, completed a geological survey of the property and is now conducting a 5,000-foot drilling program. *Sogemines Development Ltd.* is participating in the venture with *Rio Canadian*.

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January 13, 14, and 15, 1958. Nineteenth annual MINING ENGINEERING SYMPOSIUM of the University of Minnesota and the Minnesota section of the AIME. Hotel Duluth, Duluth, Minnesota.

February 6, 7, and 8. The 61st annual National Western Mining Conference sponsored by the COLORADO MINING ASSOCIATION, Mile High Center and Shirley Savoy Hotel, Denver, Colorado.

February 16 through 20. Annual meeting of the AIME. New York, New York.

March 27, 28, and 29. PACIFIC SOUTHWEST MINERALS INDUSTRY CONFERENCE, Hotel St. Francis, San Francisco, California.

March 28 and 29. The joint meeting of the AMERICAN SOCIETY OF PHOTGRAMMETRY and the AMERICAN CONGRESS ON SURVEYING AND MAPPING. Shoreham Hotel, Washington, D. C.

April 13 through 18. National Meeting of the American Chemical Society featuring CHEMICALS FOR THE MINING INDUSTRY. San Francisco.

April 17 through 19. Annual convention of the WYOMING MINING ASSOCIATION, Casper, Wyoming.

September 1 to 13. Second International Conference on PEACEFUL USES OF ATOMIC ENERGY, Geneva, Switzerland.

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Flaiks. Small lots, New York 36.00¢

"" Ingots (5 pounds). F.o.b. refinery, Port Colborne, Ontario 75.50¢

To July 1, 1962 AEC will pay \$30.00 to \$40.00 per gram depending on

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99.5%, per pound \$7.50

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Sponge, Per Pound, Reactor Grade \$7.50

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Germanium dioxide, high purity, gram 24.00¢-30.00¢

98% (per pound) \$11.00-\$14.00

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Prime Western: F.o.b. E. St. Louis 10.00¢

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Sticks and bars, up to 5 ton lots (Price per pound) \$1.70

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Powder Nom., per pound \$120.00

Germanium dioxide, high purity, gram 24.00¢-30.00¢

98% (per pound) \$11.00-\$14.00

Carbonate 36.00¢

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Flaiks. Small lots, New York 36.00¢

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99.5%, per pound \$7.50

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Nominal, per kilogram \$40.00

Nominal, per pound \$7.725

United States Treasury Price \$35.00 per ounce

Newly mined domestic. United States Treasury price 89.75¢

Foreign Handy Harmon 90.375¢

Per Ounce \$77.00-\$80.00

Sponge, Per Pound, Reactor Grade \$7.50

COLUMBIUM:

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Foreign Copper. Valley basis 27.00¢

Custom 25.00¢

Common Grade. New York 13.00¢

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Prime Western: F.o.b. E. St. Louis 10.00¢

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- 12—31 CF Card Rocker Dump Cars, 24" Ga.
- 60—27 CF Koppel Rocker Dump Cars, 24" Ga.
- 2—3-Ton Whitcomb Battery Locos., 24" Ga.
- 2—No. 12-B Eimco Muckers, 18-24" Ga.
- 2—No. 21 Eimco Muckers, 24-36" Ga.
- 2—No. 40 Eimco Muckers, 24-36" Ga.
- 2—396 CFM Sullivan Air Compressors.
- 1—20 HP Sullivan 3-Drum Elec. Slusher.
- 1—30" Pacific Slushmaster Scraper
- 1—100 HP (7500#) Vulcan 1-Drum Hoist.
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COMPRESSORS, AIR

1—450 CFM Chicago Pneumatic, 100 Hp Motor
1—1500 CFM Worthington, 300 Hp, Syn. Motor
1—2000 CFM 1-E Motor PRE-2, 500 Hp Motor

HOISTS:

1—80 HP Nordberg, double drum, Excellent
1—900 HP Allis Chalmers, double drum
1—375 HP Wellman-Seaver-Morgan, Double Drum
1—150 HP Wellman-Seaver-Morgan, Single Drum
1—300 HP Wellman-Seaver-Morgan, Single Drum
1—150 HP Vulcan Denver, Single Drum
1—100 HP Coeur d'Alene Single Drum
1—75 HP Vulcan, Single Drum

HOISTS—TUGGERS—SLUSHERS

4—450000 B Ingersoll Rand Slusher, air
1—1000 B Sullivan, 2-drum

1—1500 B Ingersoll-Rand 2 drum

1—HDE-2 Sullivan, 2-drum, 440 Volt

1—LF 211 Joy Tugger

5—EUA Ingersoll-Rand, Tugger, air

6—E 211 Sullivan Tugger, Turbineair

1—D61L Ingersoll-Rand, Tugger, Air

2—E111 Joy Tugger, Air

1—500000 B Ingersoll-Rand Slusher, 3-drum

LOCOMOTIVES:

1—1½ ton Mancha, Battery, 18" Ga.

1—2½ ton Greensburg, Battery, 18" Ga.

1—4-ton Mancha, Battery, 24"-42" Ga.

1—Tramaire, Air operated, 24" Ga.

1—4-ton Mancha Diesel, 18" Ga.

1—4-ton Baldwin Westinghouse Battery, 30" Ga.

LOADERS:

5—#12-B Eimco Mucking Machines, 18"-24" Ga.

3—#21 Eimco Mucking Machines, 18" Ga.

1—105 Eimco Crawler Loader, 1½ yd. overburden

CRUSHERS:

1—10" x 21" Telsmith, Jaw, R. B.

2—36" x 48" Birdsboro Buchanan 150 Hp Motor

2—60" x 24" Traylor Crushing Rolls

1—5½" Symons Cone, 200 HP Motor

CRAZIFIERS:

1—36" x 15" Wenno Spiral, 1½ HP Drive

1—45" x 17 3/4" Akins Spiral, 3 HP drive

1—PECO Hydraulic Type, 6 comp., 8" x 8"

1—12" Durr Quadruplex Rake Classifier

FEEDERS:

1—5 1/2" x 16" Stephens-Adamson Apron Type

1—36" x 72" Jeffrey Grizzly, 440 Volt

1—12" Hardinge Type A, Constant Weight

2—34" x 8" Denver Adjustable Stroke

FILTERS:

2—3' x 4' Oliver Drum, complete

1—1' 1-leaf Eimco Disc Type, complete

1—3' 4" x 1' 4" Oliver Disc Type, complete

1—4' 4" x 1' 4" Denver Disc Type, complete

FLOTATION MACHINES:

2—9-cell, 1x Denver, Sub A

3—cell, Size 50" x 50" Fagergren

2—cell, Size 48" x 48" Fagergren

1—4-cell, #18 Denver, Sub A

2—8-cell, #18 Sp. Denver Sub A

JIGS:

1—12" x 42" Pan American Duplex, complete

1—20" x 26" Pan American Duplex, complete

3—12" x 24" Denver Double, Complete

MILLS, ROD AND ROLL:

2—8" x 8" Marey Rod Mill

2—6 x 9" Allis-Chalmers Ball Mill

2—7 x 12" Marey Rod Mill

1—8 x 12" Marey Rod Mill

2—5 x 10" Traylor Rod Mills, w/rod charge and

drive

1—4 x 10 Hardinge Rod Mill

PUMPS, SAND:

1—Wenno Simplicity Suction Pressure

4—20" Wilfley Sand Type C

2—30" Wilfley Sand Pump

1—14" Wenno Sand Pump

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1—3' x 7' Link Belt, Single Deck

1—3' x 6' Symons Rod Deck, Single Deck

SEPARATOR:

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- 1-6 Ton Goodman Trolley locomotive
- 1-6 Ton Jeffrey Trolley Locomotive
- 2-6 Ton General Electric Battery Locomotives
- 2-7 Ton General Electric Battery Locomotives
- 1-7 Ton Jeffrey Trolley Locomotive
- 1-7 Ton Atlas Battery Locomotive
- 2-8 Ton Goodman Battery Locomotives
- 2-8 Ton General Electric Battery Locomotives

AIR LOCOMOTIVE

- 1-1½ Ton Universal "Tramaire" Locomotive

LOADERS

- 2-GD-9 Gardner-Denver Loaders
- 2-12-B Einco Loaders
- 1-HL 3 Joy Loader
- 3-21-Fimco Loaders
- 1-HL 20 Joy Loader

SHUTTLE CARS

- 1-Joy model 60 DI Battery operated
- 1-Joy model 60 D3P Battery Operated

CRANES

- 1-2 Ton Electric Overhead Travelling Crane
- 3-2 Ton Hand Operated Overhead Travelling Crane
- 2-5 Ton Hand Operated Overhead Travelling Crane
- 1-50 Ton Northern Electric Overhead Travelling Crane
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- 3400 feet—4" light weight pipe with grooved ends and Victaulic Couplings

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- 500 feet—16" steel vent pipe, 14 ga.
- 945 feet—18" steel vent pipe, spiral weld, 12 ga.
- 1270 feet—20" Naylor steel vent pipe, spiral weld, 14 Ga.

ELECTRIC TUGGERS AND SLUSHERS

- 4-5 HP Sullivan, 2 drum slushers
- 1-5 HP Sullivan tugger
- 2-7½ HP Sullivan tuggers
- 1-10 HP Sullivan 3 drum slusher
- 2-15 HP Ingersoll-Rand size 15NN-IG. 2 drum slushers
- 2-20 HP Ingersoll-Rand size 20NM2C. 2 drum slushers
- 1-50 HP Sullivan Model CF-211 double drum slusher

AIR TUGGER HOISTS

- 1-Ingersoll-Rand Model DU
- 2-Ingersoll-Rand Model D6U
- 4-Ingersoll-Rand Model IH
- 1-Sullivan Model E-111
- 9-Ingersoll-Rand Model EUA
- 1-Ingersoll-Rand Model 10-H
- 8-Gardner-Denver Model HK
- 2-Joy "Turbair" Model F-113
- 1-Sullivan Model L-111
- 2-Ingersoll-Rand Model 10HR
- 1-Sullivan Model HA 3
- 3-Ingersoll-Rand Model H4

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- 1-10 HP Sullivan Model HD-10-B double drum slusher driven by Continental gas engine

MULTI-STAGE PUMPS

- 2-2" Ingersoll-Rand 2 stage motor pumps 150-250, GPM, 325-500 ft. head
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- 4-2½" Pennsylvania 4 stage pumps 200-250 GPM, 325-520 ft. head
- 1-2½" Pacific 6 stage pump 150-200 GPM, 450-680 ft. head
- 1-3" Allis-Chalmers 3 stage pump 400 GPM, 250 ft. head
- 2-3" United 5 stage pumps 110-350 GPM, 550-700 ft. head
- 3-3" United 6 stage pumps 180-350 GPM, 700-900 ft. head
- 1-4" Ingersoll-Rand 2 stage pump 1000 GPM, 920 ft. head
- 1-5" Manistein 8 stage pump 340 GPM, 500 ft. head

JAW CRUSHERS

- 6-2½" x 3½" New Morse Lab Jaw Crusher
- 6-4" x 6" New Morse Lab Jaw Crushers
- 1-5½" x 7" Joshua Hendy Jaw Crusher
- 1-7½" x 10" Rogers Jaw Crusher
- 1-8" x 15" Wheeling Jaw Crusher
- 2-9" x 16" Universal Jaw Crusher
- 1-10" x 16" Rogers Jaw Crusher
- 1-9" x 36" Cedar Rapids Jaw Crusher
- 1-15" x 36" Universal Jaw Crusher
- 1-42" x 48" Taylor Jaw Crusher

BATTERY CHARGERS

- 12-400 Watt 12 volt gas engine driven
- 10-850 Watt 12 volt gas engine driven
- 1-2½ KW Westinghouse 66.5 volts
- 1-10 KW Hartner, 150/180 volts
- 2-10 KW Hartner, 103/119 volts
- 1-11½ KW Westinghouse, 125 volts
- 1-11 KW Joy D. C. balancer type, 126.5 volts
- 1-15 KW General Electric, 146/167 volts
- 1-15 KW Electric Products, 132 volts
- 1-20 KW Joy, 126.5 volts
- 3-22 KW Wotton D. C. balancer type, 132 volts
- 1-50 KW Hartner, 155 volts
- 4-250 Volt D. C. battery charging switchboards

MOTOR GENERATOR SETS

- 1-2½ KW Western Electric, 440 V A.C.—250 V D.C.
- 1-3 KW Westinghouse, 220/440 V A.C.—250 V D.C.
- 1-5 KW Crocker-Wheeler, 250 V D.C. gas engine driven
- 1-6 KW Ready Power Unit Model H-48, 48 V D.C. gas engine driven
- 1-7 KW General Electric, 440 V A.C.—125 V D.C.
- 1-30 KW General Electric Welding Generator Unit, 60 volt generator, 550 V D.C. motor.
- 1-40 KW General Electric, 220/440 V A.C.—250 V D.C.
- 1-75 KW Westinghouse, 440 V A.C.—250 V D.C.
- 1-75 KW Ridgway, 4000 V A.C.—125 V D.C.

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1-50 ft. steel headframe with 2-5' headshaves and 75 HP double drum Vulcan Hoist

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Rotary Kilns: 8' x 125', 9' x 201', 11' x 201'
Patterson 5' x 22' Ball Mill—UNUSED
Rotary Divers: 4½" x 40', 6" x 50'
Hammer Mill: Jeffrey 54" x 30", 100 HP

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MINE HOISTS:

One Nordberg 10' dia., 10' face, double drums, both clutched, 1½" rope, 1200 FPM, clutches and post brakes hydraulically operated, dial indicators and type D Lillies are gear driven, motor 1250 H.P., 2200 volts, 3 phase, 60 cycle, 443 RPM, with all controls purchased new 1950.

One single drum 7' dia., 7' face, 1½" rope, 1200 FPM, post brakes, type D Lilly, 400 H.P., 2200 volts, 3 phase, 60 cycle.

One single drum 10' dia., 7' face with center flange, wraps 2500 ft. 1½" rope on each side of center flange, motor 400 H.P., 3 phase, 60 cycle, 2200 volts, all modern safety features and controls.

One single drum 8" x 60" face, 1½" rope, 32,000 lbs. SLP, 400 FPM, 150 H.P., 2200 volts, post brakes, type D Lilly, with or without 8" dia. roller bearing sheaves. Thoroughly modern, new condition.

One Ingersoll Rand 4' x 4' double clutched drums with 150 H.P. motor.

One single drum 5' dia., 5' face, with center flange, each side 2½", wraps 1500 ft. 1½" rope in 4 layers, 750 FPM, 100 H.P. motor, 3 phase, 60 cycle, 2200 volts, 570 RPM, dial indicator and Lilly are gear driven, post brakes oil operated, complete with all controls.

Complete specifications, photos, foundation plans available.

KILNS, COOLERS & DRYERS:

Kilns: 5' x 40', 5' x 50', 7' x 40', 6' x 60', 7' x 125', 9' x 120', 6' x 130'.

Dryers: 4' x 35', 9' x 50', 8' x 70 ft. One steam dryer 6' x 50'.

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Parties to join me in my investigations for

COLUMBIUM

and Tantalum and the Rare Earth Minerals. My own investigations have been in progress for four years. Currently in the Mohave Desert area of California. Have my own laboratory and years of experience in investigating and prospecting for deposits of the strategic and critical minerals. Would welcome financial participation pointed towards speeding up this important work.

Your opportunity to help catch up with Sputnik.

John W. Riffe, Mineral Technologist
185 Summit St. Phone TU 5-4429 Auburn, Calif.

Rotary dryer: 5 ft. dia. x 55 ft.

Flotation: Two 3-cell and one 2-cell Fog 44x44" cells; straight-flow, v-belt-dr.

Flotation: One 2-cell 32x32 Denver Sub-A Filter: DECO, 4-Leaf 4 ft., with vacuum eq. & motors.

Thickener: DECO, 16 ft. dia., low-head, encld gear, gearmotor (No tank).

Tables: 2 Diester diagonal deck

Air Slusher: 2-drum GDCO, Model HKE

Muckers: Eimco 12-B and Sullivan HL-3

D17000 Cat. w/85 kw Louis-Allis gentrr.

Mine Hoist: Vulcan 2-drum with 50 hp GE

MTC 440-v slippng motor, etc.

PAUL F. SMITH

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President of reputable expanding mining corporation requires mining engineer as staff assistant who is experienced in open-pit mining methods and equipment. Real opportunity for young man now employed in mine management, desirous and capable of advancement not available on present job. Salary in range of \$13-\$15,000. In confidential letter give age, education, experience including present job, and salary. Reply Box P-3, Mining World, 500 Howard Street, San Francisco 5, California.

OPERATION SUPERVISOR: America, 33, married, 2 years college, ICS diploma in Industrial Metallurgy. 12 years experience as miner, mill operator, metallurgist, time study and efficiency engineer, metallurgical statistician, both mine and mill shift foreman, concentrator operations foreman, assistant general mill foreman and crusher foreman in both large western copper mining company and Iron Range low-grade iron concentrator. Seeking permanent position with a progressive mining company, preferably supervisory or management position. Reply Box R-1, Mining World, 500 Howard Street, San Francisco 5, California.

WANTED: Dry gold placers; preferably with engineering; arid conditions desirable. State acreage, values, location and all pertinent information. Prepared for immediate production. J. W. Martin, Box 189, Tucson, Arizona.

WANTED: Party with long term mining lease on calcite deposit consisting of 250,000 tons on surface and 755,000 tons sub-surface, assaying 96% calcium carbonate, located in Oklahoma, with market already contacted and approved, desires mining company as partner to handle transaction and mining. Principals only, no promoters. Company must finance. Will be given free hand and good deal. Deposit engineering report sent on request. Write 1801 Oxford Way, Oklahoma City, Oklahoma.

WANTED: Will purchase or explore and develop iron ore deposits in the Southwest. Send all available information, engineering, geology, location, and size, etc. J. W. Martin, Box 189, Tucson, Arizona.

FOR SALE OR LEASE: Large zirconium deposit. Write to P.O. Box 96, Prince Rupert, B. C., Canada.

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2-Std. 3 yd. shovels, new 1951
fob cars Midwest location
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DENVER ROUGHER FLOTATION

**SAVES
\$15,000
YEARLY***

* Recent Case History

Mill: 4,000 T.P.D. low-grade copper ore.

Circuits: Two 2,000 ton per day parallel flotation circuits.

Flotation Machines: DENVER Roughers and a leading competitive rougher. All of the cleaner cells were DENVER "SUB-A's."

Operating Conditions: Identical.

Metallurgy: Equal.

Initial Cost: Substantially the same.

Power Savings: With equal metallurgy and equal tonnage the DENVER Rougher circuit SAVED approximately \$10,400 per year over the competitive circuit!

Part-life Cost: Longer wearing life of DENVER parts saved an estimated \$4,500 additional per year!



Unseen Factors Control Your Net Profits...

Even though this \$15,000 saving per year per 2000 ton circuit did not appear on an assay sheet it was real and vitally important. It was not overlooked when this progressive copper operation expanded their mill. They again selected DENVER Rougher Flotation Machines of the Type "M" design.

Do not overlook the unseen factors in flotation that affect YOU NET PROFITS. Specify DENVER Flotation. Your economic success assured by DENVER's proven world-wide leadership in Flotation.

Flowsheet recommendations submitted
without obligation. **WRITE TODAY!**

"The firm that makes its friends happier, healthier and wealthier"



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Ready for shipment
are these Wilfley
Model "K" sand
pumps manufactured
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Day after day, in industrial plants throughout the world, the always-dependable quality of Wilfley Sand Pumps pays off in lower pumping costs. Wilfley Sand Pumps give you all these dollar-saving features:

- Maintained high efficiency
- Longer pump life
- Quick, easy replacement of worn parts
- Rugged construction

- Versatility of interchangeable materials in wear parts: hard alloy irons or soft abrasion-resistant rubber.

- Simple, efficient design for trouble-free operation.

Individual Engineering on Every Application

Wilfley Sand Pumps
"Companions in Economical Operation"
Wilfley Acid Pumps

Write, wire or phone for complete details.

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